A Study of Renewable Energy Investment Practice

In

United Kingdom and Nigeria

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By

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Declaration

Candidate's declarations:

I, SAMESA IGIRIGI, hereby certify that this thesis submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy (PhD), Abertay University, is wholly my own work unless otherwise referenced or acknowledged. This work has not been submitted for any other qualification at any other academic institution.

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Supervisor's declaration:

I, Dr Daniel Gilmour hereby certify that the candidate has fulfilled the conditions of the Resolution and Regulations appropriate for the degree of Doctor of Philosophy in Abertay University and that the candidate is qualified to submit this thesis in application for that degree.

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I certify that this is a true and accurate version of the thesis approved by the examiners, and that all relevant ordinance regulations have been fulfilled.

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ABSTRACT

This research aims at appraising the decision-making approach as applied in renewable energy investment across different markets. An alternative viability assessment framework is adapted from the Bossels viability approach, which facilitates indicator prioritization. The goal of the study was to appraise the decision making process and validate the framework. A case study approach was adopted as it offers the opportunity to gain depth. The adapted framework was tested across four of five cases, one case found the framework too subjective.

The existence of market transition was acknowledged in 2 cases and leapfrogging in 3 cases, but it did not lead to market migration by developers. However, it did have an effect on process, especially for the UK firms experiencing market deterioration with the firms introducing tighter screening and analytical processes. The level of process rationality as observed in the UK and Nigerian cases are significantly influenced by regulatory requirement. The decision-making processes as shared by the cases confirmed that the rational approach still forms a significant part of organisational decision-making. The four cases all associated more decision-making indicators to the Fit theme with the least influential theme been the Flexibility theme. Indicator association was different across the different classes of developers who were at different market stages of development, showing a marked difference in strategic intent. These findings extend the viability discussion to a more macroscopic level placing relevance on the developer's interest. The indicator associations and prioritization show policy makers where to focus policy initiatives that will incentivise developers across these different market spheres.

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ABBREVIATIONS

CFD	Contract for Difference
COP	Conference of Parties
CSR	Corporate Social Responsibility
DM	Decision Making
DMP	Decision Making Process
ECREE	ECOWAS REGIONAL CENTER FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY
EPC	Equipment Procurement Contract
ESIA	Environment Social Impact Assessment
FID	Final Investment Decision
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
IPP	Independent Power Producer
LCA	Life Cycle Analysis
LCE	Low Carbon Economy
MCA	Multi Criteria Analysis
NERC	Nigerian Electricity Regulatory Commission
O&M	Operation and Maintenance
OECD	Organisation for Economic Co-operation and Development
PPA	Power Purchase Agreement
RE	Renewable Energy
REF	Renewable Energy Foundation
RES	Renewable Energy Solution
RO	Renewable Obligation
VP	Variable Pitch
SC	Strategic Choice
SD	Strategic Decision
SDM	Strategic Decision Making

Chapter 1 INTRODUCTION

1.1 Context of Research

The development of renewable energy solutions is one of the pathways to achieving sustainable development. The approach focuses on energy generation using naturally occurring resources such as solar, wind, water, energy crops and waste with the goal of correcting dependency on fossil fuel in developed and developing countries as well as driving rural electrification. These development initiatives are facilitated by governments through policy and implemented by electricity utility companies, entrepreneurs and homeowners in some cases across the globe. The view of the renewable development environment as one involving different developer groups with operations within national and potentially across international boundaries shows the diversity in the sector. The diversity dimensions as mentioned above can be categorised into varying renewable options, country and actor differences but the country and actor dimension are the domain of interest in this research.

Country diversity is considered to be critical since country specific social, institutional and economic conditions shape the renewable development pathway (Kim and Park 2016; Bhattacharya et al. 2017). This is represented by nature of the electricity markets with respect to its maturity, institutional and bureaucratic processes as applied. In this research the United Kingdom (UK) and Nigeria are used as representation of different locales. The electricity market in the UK has evolved from been a state-owned system to deregulated system adopting renewables in the late 1990. The Nigerian electricity market was once state-owned but now deregulated with advocacy for renewables pioneered in 2005.

The timelines indicate the potential difference in level of development of the renewable energy sector. Therefore, developing market particularly

Nigeria has the advantage of learning from more experienced systems in this case the UK.

Actor diversity forms the second dimension captured within the development process. The difference in actors participating in the sector points to the existence of possible differences in strategic interest that will arise in the establishment and definition of decisions.

Since the development of renewable projects involves diverse actors, and depends on different operating conditions as introduced by the countries of implementation. It is important to understand how these factors affect, influence the decision-making process, and how actors adjust their processes to match their inherent operating conditions.

1.2 Need for the Research

Diffusion of innovation is defined as a process involving the communication of a new idea or solution across a social system (Rogers 2003). This process involves an exchange of information and decision-making among actors. With the emergence of renewables classed as an innovation in the electricity generation landscape, there arises the need for the adoption of the diffusion mechanism as a means of penetrating the potential system of adoption.

The diffusion mechanism adopts the system-based approach necessitating the thorough analysis of the innovative solution and the system for which an innovation is targeted. The system dimension allows for the identification of operational and market states that define resources and constraints, also it allows for the identification of actors who are the implementers and adopters of these innovations.

Although the founding ideas for renewables go far back as the photovoltaic invention by Edmond Becqurel in 1839, the adoption and progressive implementation of these solutions have been uneven. This can be linked to the level of maturity of solutions, which ultimately affects cost and availability. With developed countries pioneering the research and development of these solutions, there is an associated high rate of diffusion as compared to developing countries.

This disparity in the rate of diffusion as noticed in developed and developing countries, directly translates to disparity in levels of investment and development of the renewable sector, which could be attributed to the country specific conditions such as resource availability, institutional framework, political instability and failing infrastructure amongst others. These conditions point to the state of the operating environment and stage of market development. Therefore in ensuring the effective diffusion and development of renewables especially in developing countries, there arises the need to consider the unique peculiarities these conditions introduce to potential developers in the course of decision-making.

Utility companies and independent power producers make up the pool of potential developers at the centre of the drive to develop renewables, they seek to generate electricity through cost competitive generation approaches while making profit. The adoption of renewables by potential developers as an option for electricity generation is challenged due to the viability question when compared to cost effective conventional energy generation.

Viability as utilized in this research refers to the ability to achieve the minimum positive expectation that matches the requirement of a system (Bossel 1999). Since systems are a product of their component entities, viability in this case is achieved when the minimum positive expectation of all players in the renewable energy market is attained. Essentially viability has to go beyond just economic goal but also capture social, environmental and social goals in line with sustainability principles. Significant research has been undertaken in areas of techno-economic and feasibility analysis of technologies and project cases. This has been considered as representing viability assessment, however the focus has been on the technology and its potential application case. There exist a gap in the consideration of viability assessment from the developer’s perspective.

It was mentioned earlier that peculiar country conditions indicate the possibility of developers to experience different stages of market development as they engage in development activities. Therefore, it is plausible to argue that these unique conditions could have some effect of this on decision-making processes as applied by developers.

This is quite significant on two fronts, the first been that the decision-making process acts as a lens through which developer preferences can be identified. As such decision-making indicators and success factors can easily be identified as they apply in the different stages of market development. Secondly, policy development in developing countries can benefit from the knowledge of developer indicator preference, as targeted policies can be designed to attract developers from developed countries.

This research looks at the potential effect of changes in markets on decision-making process introduced by diffusion.

1.3 Aims and Objectives

The outline in Section 1.2 highlighted the unique state of the renewable energy market; drawing attention to the potential challenges developers may face when they make decisions due to country specific factors that translate into the nature of the market. These challenges will affect the definition of indicator, refinement of strategy and process, which is reflective of the developer's preference and constrained by the operating environment.

Since the above is encapsulated in the decision making process, there is need to review the decision making process as applied in these conditions and also revaluate the viability assessment approach adopted as well. Hence, the viability assessment is considered from the system perspective. The elements that promote system coexistence and longevity as idealised in the viability and sustainability argument are explored in this research. Finally, the changing state of the market, diversity in the interest of actors indicates the need for the review of concept of viability, which essentially drives business interest captured within the process of decision-making.

The research aim is:

To establish the extent to which viability assessment and process definition are affected by the process of market transition in the renewable energy development environment.

The objectives are:

1. To establish the link between risk and sustainability as it relates to renewable energy projects (addressed in Chapter 2 & 6)
2. To develop a viability assessment framework (addressed in Chapter 3)
3. To identify the existence of market transition within the development of renewables
    1. To identify if market transition impacts on decision-making process (addressed in Chapter 3 & 6)
    2. To validate and test the framework under prevailing market condition (addressed in Chapter 6)

4. To establish the existence of criteria prioritization using the viability assessment framework (addressed in Chapter 6)

The fundamental research question;

1. What is the link between risk and sustainability from the developers' perspective?
2. What system-based approaches can be adopted in the definition of viability assessment standard for developers?
3. How does the transition affect the market and process of decision-making?

1.4 Research Methodology

The philosophical grounding and methodical approach for this research are described in Chapter 4. The philosophical underpinning, research strategy and methods of research were identified and selected as appropriate to achieve the research objectives as stated in Section 1.3. This research can be broken down into three different parts, extensive literature review, conceptual and theoretical framework development, case study analysis with test and verification of framework using business cases.

The initial task was to develop a coherent understanding of the renewable development domain considering diffusion theory, organizational and policy dimensions while identifying emergent themes. This was conducted through extensive literature review, which led to the identification and development of the questions.

The second part of this research involved the development of a conceptual, theoretical and viability framework. Theories that address the research questions were considered extensively leading to the development of both theoretical framework and the conceptual framework that finally led to the definition of the viability assessment framework. These ideas were verified using interviews with the outcome been the refined open-ended interview protocol and the viability assessment matrix. This involved the definition of the appropriate questions for identifying the existence of market transition, decision-making protocols and viability assessment approach.

The third part of the development involved the use of open-ended interviews, documentary analysis and the administration of the viability assessment matrix within the cases of interest. This involved five (5) business cases in the United Kingdom and Nigeria with interviews across all five; it also involved the document analysis to cross-reference and map responses to ascertain reliability. Finally a viability matrix was administered to the participating cases, this mixed methods approach further improved the validity of the application and findings.

This was followed by a systematic comparative analysis across the cases with the development of a map decision-making process and indicator prioritization.

1.5 Structure of the thesis

The thesis is structured around seven chapters. Chapter 2 presents the findings from extensive literature review on the concepts of energy security and low carbon economy that gives rise to the consideration of renewables. It also reviewed the renewable energy development pathway, which highlights the interaction between technology and policy. Thus setting the stage for diffusion with regards to technology innovation and the potential effect these changes introduce to the developers. Underlining these interactions is the question of the appropriateness of decision-making, viability and sustainability protocols in the face of changing market system.

Chapter 3 presents a review of the theory of the firm, transition and decision-making theory. Within these different themes, the research propositions were developed and defined. Finally, the viability assessment framework was developed and justified on the basis of Bossel viability assessment theory

Chapter 4 describes different methodological approaches used in research and the justification for the inductive approach as the method for this research. The chapter also explores the selection criteria for cases and their justification.

Chapter 5 describes the data collected from the various cases and offers an overview the analysis strategy.

Chapter 6 presents the analysis of the data in line with the analysis strategy. In this chapter, the various research questions and propositions are addressed on a case-by-case basis and finally a comparative analysis across cases is reported.

Chapter 7 presents the conclusions, recommendation and limitations of the study. Appendices are presented which contains additional information that supports analysis and findings presented in Chapter 6.

Chapter 2 LITERATURE REVIEW

2.1 Introduction

This chapter introduces three concepts relevant to renewable energy development. The three concepts considered in the development and deployments of renewable energy solutions are drivers and barriers, diffusion of innovation and decision-making and assessments methodologies. Their interaction, present interesting research questions and propositions that challenge utilities and private developers (entrepreneurs and home-owners) interested in developing renewable energy solutions (RES).

The triggers that prompt the emergence of renewables are discussed in Section 2.1.1 and Section 2.1.2. Section 2.2 addresses the Renewable development landscape while barriers and drivers of development are discussed in Section 2.3. In Section 2.4, diffusion and renewable development are discussed while Section 2.5 addresses decision-making as seen within literature involving renewable development.

2.1.1 Energy Security Concepts and Approaches

Energy security is considered a topical issue amongst energy policy experts, business stakeholders and the larger society (Ang, Choong and Ng 2015). This is because energy and its allied services are a major driver of modern economies and lifestyle.

The growing need for energy, the adverse negative effects of fossil fuel exploitation and its use are contributory reasons for the calls for control on the existing conventional energy options and the exploration of cleaner alternatives. Exploration of cleaner energy options forms a part of this global energy security strategy of which adopting renewables play a significant part (Athenas and McCormick 2013; Obama 2017). In understanding why the adoption of renewables is so significant there is a need to review the concept of energy security.

Energy security as defined by the International Energy Agency (IEA) is the uninterrupted availability of energy sources at an affordable price (IEA 2014). This definition highlights the importance of two key parameters, resource availability and cost, which shape national energy and business strategy. Ensuring a steady availability of energy resources at a price that is considered reasonable is a critical goal for every nation, since most economic activities are dependent on this key resource (Bompard et al. 2017;Chalvatzis and Ioannidis 2017). Similarly, businesses that rely on various forms of energy to deliver products and services, consider the security of energy supply to be significant in defining their ability to conduct business.

In more recent times sustainability, efficiency and diversity have emerged as goals to be met by addressing energy security. Cherp and Jewell (2014) acknowledged the resource availability issue as articulated in the classic energy security classification associated with the situation during the crisis of the oil shock.

However, this was taken further in the alternative representation of the contemporary energy security classification that highlighted the dimensions of sustainability, efficiency and accessibility (Li, Shi and Yau 2016). After considering both classifications, Cherp and Jewell (2014) defined energy security as achieving low vulnerability in vital energy systems, looking at the idea beyond its basic energy supply perspective but fundamentally a security issue.

Baumann (2008) also considered energy security from a security perspective, its definition highlighting the potential failings that could be associated with the absence and inadequacy of supply. With the risks associated with potential failings forming a significant threat to national stability, Chester (2010) concentrated on the market outcome; hence energy security is considered to represent the achievement of efficient market conditions that corrects for the possibility of supply risks or failings.

Evidently, the energy security concept focuses on ensuring supply of energy as its primary goal. On the other hand, there are secondary level goals, which are domain dependent as highlighted in the interaction of stakeholders and the energy systems (Ciuta 2010;Sovacool and Brown 2010). In this instance energy security is considered a means to achieving system-level objectives.

With the relevance of security in supply established, there lies the issue of identifying suitable methods and approaches to be adopted in meeting this need. Baumann (2008) considered four areas (internal policy, economic, geopolitical and security) to be exploited if this challenge is to be addressed.

These different areas highlighted approaches through which the issue can be tackled, however the internal policy domain looked tackling energy security by effectively investing in infrastructure, promoting efficient processes and energy diversity. Energy diversity introduces the use of renewable energy sources for the promotion of a diverse energy mix.

Similarly, the work of Chester (2010) addressed energy security on the basis of function it could serve, stating risk management, strategic intent, energy market categorization and promotion of energy diversity as potential functions. The energy diversity domain emphasized the relevance of renewables in correcting the energy dependency challenge for countries heavily reliant on energy import.

Månsson, Johansson and Nilsson (2014) identified energy efficiency, energy diversity, resilience, risk and infrastructure as factors energy security addresses. However, the focus on energy diversity and the use of renewables represents both a risk management and energy security strategy.

Securing supply of energy forms the foundation for energy security, this has led to the emergence of renewables as one of the approaches to address the energy security issue. Lucas, Francés and González (2016) research on energy security and renewables captured the value of renewables development beyond addressing the energy security challenge to tackling environmental concerns. Therefore, the advocacy for renewables is justified on the merit as being more than a solution to the global energy security problems but also one that facilitates the decarbonisation of the global economies. This represents the overarching goal to be achieved in the low carbon economy.

Consequently, to achieve the low carbon economy, the issues of climate change and energy security has to be considered from an energy system perspective which involves the systematic introduction of energy efficiency approaches, alternative clean energy sources and matching of energy need to localised resources pools (Foxon 2013;Mattes, Huber and Koehrsen 2015). The development and use of renewables across the different energy sectors amongst other energy security strategies are captured within the low carbon economy approach (Bridge et al. 2013; Hertwich et al. 2015).

2.1.2 Climate Change and Low Carbon Economy

The previous section introduced the energy security concept as a multi-dimensional issue with the adoption of energy diversity as a potential solution. The drive for energy diversity is encapsulated within the low carbon economy strategy; an approach to tackling the energy security challenge by adopting energy system wide change, including renewables while also tackling the underlining climate change issue.

Energy as an integral part of human and economic development is essential for improvement in quality of life all over the world (IEA 2013; Salameh 2003). Consequently with the growing world population and resultant migration of people to the already energy intensive urban centre, there is an inevitable rise in demand for energy. This growing need for energy and associated climate change concern from the continuous use of fossil fuel has propelled the interest in delivering products and services in a manner that promotes efficiency in resource use with the intention of lowering environmental burden and preserving the environment. From the policy standpoint, the involvement of national players has been evident with the drive to tackle climate change since the Conference of Parties (COP) in 1995. More recently the COP 24 in Poland reiterated the position of world leaders to address the issue of climate change effectively through national and local policies that facilitate process change, one of which is the low carbon economy.

The low carbon economy is one that seeks to reduce the carbon emissions, energy consumption, pollution and material use while delivering similar or improved standard of economic and social value (Chen et al. 2010; Zhang 2010). Therefore, the low carbon agenda implementation has been operationalized through process change (Wang and Chang 2014), community energy governance (Markantoni 2016) and changing human behaviour. This involves the adoption of control strategies with the goal of fostering innovation in the existing systems while lowering the general energy requirement, in addition, to delivering overall cost reductions on the side of the direct consumer.

Within the electricity generation sector, the agenda is epitomised through the promotion of varying strategies including diversification of the electricity generating pool, self-generation or onsite generation for industries (Foxon and Pearson 2007;Cherry et al. 2014) using renewables. The work of Bongardt, Breithaupt, and Creutzig (2010) looked at low carbon cities, considering interactions between housing, electricity, transportation, waste-management and the natural habitat. This work highlighted that the low carbon economy was only achievable if there was a convergence between actions by stakeholders and policy commitment. The low carbon economy strategy as it applies to electricity generation advocates for overall system change, which will require a system wide approach (Mattes, Huber and Koehrsen 2015;Wainstein and Bumpus 2016).

Although timely and relevant, this has its inherent challenges at both top and bottom levels. Top-level concerns as presented by Fortes et al. (2013) are economic while bottom level issue are technological. Berkhout et al. (2004) suggested the focus should be on bottom level expansion of niche markets. Fortes et al. (2013) categorised top and bottom concerns into macro-economic and infrastructural challenges respectively. The top and bottom level issues have to be considered in decision-making process by policy makers and developers facilitating the intended change. Decision makers in government, utilities and private developers are confronted with the task of assessing energy options that fit this new strategy (MacArthur 2016; Reusswig, Komendanntova and Battaglini 2018). Considering that renewable energy options are intermittent in nature and relatively new in comparison to the conventional options, the decision to adopt will be achieved by matching constraints posed by the operational environment with organizational goals, in order to establish the viability of these solutions. This process of matching constraints against goals will perhaps be different across the various classes of decision makers, with this further escalated when they make these choices under unfamiliar market conditions (Masini and Menichetti 2012;Kumar et al. 2017).

Asides the climate change issue tackled by implementing the low carbon economy approach, it builds into the idea of self-preservation founded within the core principles of Darwinism and theory of the firm (Roggema 2016; Chang, et al. 2017; Frantzeskaki et al. 2018). Essentially this approach prompts organisations and nations to act in their best interest by attempting to manage their resources and adopt smarter systems. The effect of this includes lowering impact on the human and operational ecosystem as well as facilitating cost reduction through compliance and avoidance of litigation (Heidari and Pearch 2016).

Furthermore, the self-preservation notion promotes compliance and long-term cost reduction, which is a product of the theory of the firm. The theory of the firm (Holmstrom and Tirole 1989) as discussed in Chapter 3 Section 3.1 addresses the idea that every firm and business interest has a fundamental duty to its stakeholders which involves profit maximization at the least attainable transaction cost to stay relevant in their market of interest.

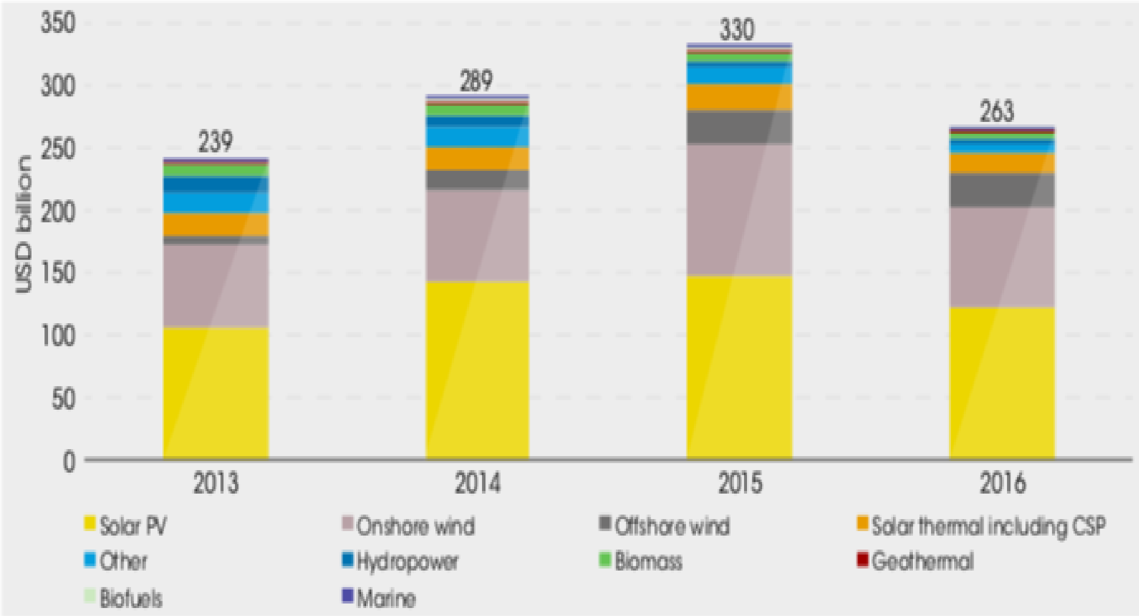
The potential short and long-term benefits of adopting energy management strategies offer a buy-in for firms, however the key question of cost has to be answered. These different strategies are reliant on a diffusion process (Fan and Dong 2018), which will require sound decision-making facilitated by assessment methodologies standardized through practice and experience. Having identified the triggers for the promotion of renewables as a potential source for clean energy development, the next section explores the renewable energy development landscape.

2.2 Overview of Renewable Energy Development

The primary energy sources are categorised into three, which are fossil fuels, nuclear and renewables with fossil fuels being the most used. In 2006 total primary energy consumed was 11837.180 million tonnes of oil equivalent (mtoe) of which fossil fuel contributed the staggering 81% with percentages of 34% oil, 21% for gas and 26% for coal (IEA 2008) while renewables and nuclear accounted for the 19%, as opposed to 13761.40 mtoe reported in 2017, indicating continuous growth in the use of fossil fuel based energy sources.

These fossil fuel based options are depleting natural resources that have limited availability, they also contribute significantly to CO_2 emission and are considered to be a major contributor to the climate change issue (Hook and Tang 2013; Abas, Kalair and Khan 2015). Renewables on the other hand are obtained from natural sources, which replenish over short intervals having the potential to generate energy in various forms including electricity, fuel and heat while offering carbon neutrality with no greenhouse gas emissions at least from the point source. Renewable energy development offers an opportunity to deliver energy in a sustainable manner by lowering ecological contamination and impact on the environment (Strbac 2008). This is evidenced by the rise in investment and development of renewable energy projects in different parts of the world. The Figure 2.1 below shows the investment distribution across the different renewable energy sectors between 2013-2016, although there was a noticeable decline in 2016 attributed to changing policy regimes, solar and wind still account for the largest contributions to annual investment (IRENA and CPI 2018).

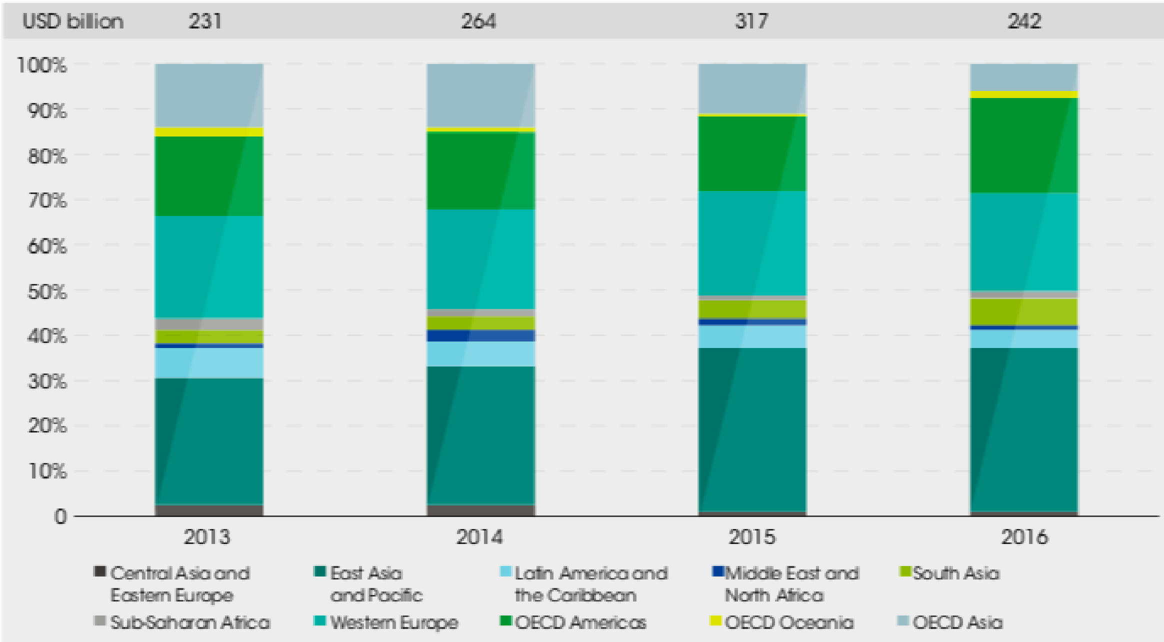
Figure 2.1 Annual Investment on Renewable categorized by type, 2013-2016 (IRENA and CPI, 2018)



Source: IRENA and CPI (2018) Global Landscape of Renewable Energy Finance, 2018, International Renewable Energy Agency, Abu Dhabi P.7

This research particularly focuses on the solar and wind energy, which as shown in the Figure 2.1 and the IRENA 2018 report are the leading renewables in terms of volume of investment. This is an indication of its efficacy in addition to the level of acceptance amongst different stakeholders (Sovacool and Raton 2012). Although growth is perceived to be far reaching in different parts of the world there is significant growth in development and investment in East Asia-Pacific and Europe (IRENA and CPI 2018).

Figure 2.2 Renewable Energy Investment by Region 2013-2016



Source: IRENA and CPI (2018) Global Landscape of Renewable Energy Finance, 2018, International Renewable Energy Agency, Abu Dhabi P.22

Figure 2.2 shows that in Europe a peak was noticed in 2015 with investment of 73 billion USD but a decline was recorded in 2016 to 53 billion, this was associated with changes in policy in United Kingdom (UK) and Germany. There was a noticeable rise in investment in the East Asia-Pacific from 64 billion USD in 2013 to 114 billion in 2015, then a decline in 2016. Similarly, there was a significant rise in the OECD Asia region from 32 billion in 2013 to 51 billion USD in 2016.

The REN21 2018 similar to the IRENA report captured the global landscape for investment in renewable and generation from renewable as shown in the Figure 2.3 below

Figure 2.3 Renewable Energy Investments in 2016-2017

		2016	2017
INVESTMENT			
New investment (annual) in renewable power and fuels[1]	billion USD	274	**279.8**
POWER			
Renewable power capacity (including hydro)	GW	2,017	**2,195**
Renewable power capacity (not including hydro)	GW	922	**1,081**
Hydropower capacity[2]	GW	1,095	**1,114**
Bio-power capacity	GW	114	**122**
Bio-power generation (annual)	TWh	501	**555**
Geothermal power capacity	GW	12.1	**12.8**
Solar PV capacity[3]	GW	303	**402**
Concentrating solar thermal power (CSP) capacity	GW	4.8	**4.9**
Wind power capacity	GW	487	**539**
Ocean energy capacity	GW	0.5	**0.5**

Source: REN 21. 2018 Renewable 2018 Energy Global Report Status. (Paris: REN21 Secretariat) ISBN 978-3-9818911-33

China and the United States are at the top the table of top 5 countries in the areas of investment and generation. China having adopted the approach of facilitating research and development, has over the years built the competence to develop technology, deploy locally and also export to both developed and developing markets (Dei et al. 2016). This could partly be responsible for the growth noticed in the renewable energy sector, particularly the solar photovoltaic sector. As an emerging economy China's rapid expansion of its investment in renewables, significantly changes its dependence on imports of any form of energy, enhancing their energy security position.

Similarly, the United States (US) has been in the forefront of the energy security debate advocating for alternative forms of energy, and this is evident in their renewable generation and investment figures. The development as noticed in the US, can be linked to the systematic separation of legislative powers for generation of electricity to the states, promoting state autonomy in the area of power generation (Wiser et al. 2007; Hess, Mai and Brown 2016).

Germany and the UK are also performing significantly well in the areas of wind power investment. Both countries are pioneers in Europe and are at the forefront of the climate change advocacy but have approached the development and deployment differently. Germany has massively promoted the involvement of small-scale producers of renewable energy and maintained consistency in its support policy routes (Kirchhoff et al. 2016;Renn and Marshall 2016). The UK has only recently started aggressively advocating for large-scale community based renewable development, however uncertainty introduced by policy and support regime changes has significantly affected the sector (Glasson 2017; Mirzania et al. 2019). REN21 (2018) Angola, Rwanda and Guinea-Bissau are the only African countries on the list. Angola is the only country contending in the area of investment in hydropower capacity, which is a renewable option outside the focus of this research. As noted in the IRENA report, the contribution of African countries is significantly low when matched against the energy need and available resource. Although the deployment figures in Africa are insignificant compared to other parts of the world, Africa stands a chance in leading the world in this transition with its available renewable resources and need for energy.

Nigeria is the African country in focus. The country is endowed with abundant conventional energy resources, which contributes over 90% of her national income (export) and is a dominant source of fuel required for electricity generation. Despite the abundance in resources, the peak value of electricity generated for an estimated population of 170,000,000 stands between 3500MW and 4000MW (Akuru et al. 2017). This energy crisis has not only pushed Nigerians to self-generate using diesel or petrol generator, it also has gradually crippled the industrial sector due to the rise in cost of production while facilitating the continual use of fuels that are carbon emitters. In this challenge lies an opportunity to pioneer the rapid engagement of the energy sector towards transition to renewables.

This has led to efforts in research as well as policy (Hua et al. 2016; Akuru et al. 2017;Osunmuyiwa and Kalfagianni 2017). Research has covered renewable potential estimations, feasibility and techno-analysis of renewable technologies as well as case applications for renewable solutions (Akinbami 2001; Shaaban and Petinrin 2014; Akuru et al. 2017; Bashir, Modu and Harcourt 2018). In terms of policy, the reforms in the Nigerian power sector has been directed toward the restructuring of the electricity market with the Electric Power Sector Reform Act of 2005 which led to the unbundling of the sector into the three independent entities (generation, transmission and distribution) (Emodi and Ebele 2016; Oyedepo et al. 2018). Also in the area of reforms, the Nigerian Renewable Energy Action Plan was passed in 2016 indicating the commitment of government to generate 16% of its electricity by 2030 from renewable sources. In addition, the policy reform also offers market incentives to developers in the form of feed-in-tariffs, grants and loans for developments at different scales across different resource categories (Emodi and Ebele 2016)

Despite these incentives the annual development numbers have not changed significantly. This points to two likely problems, firstly the appropriateness in method and approach currently utilized in the deployment and diffusion of renewables, and secondly institutional and market readiness of the sector

In summary, the Nigerian electricity market has yet to attract the right kind of partnership required to rapidly transform the sector. This failing therefore shows that even in the presence of factors considered to incentivize diffusion, attempts at promoting transition could fail. Therefore there is the need to identify barriers to diffusion especially at the country level as the peculiarities associated with diffusion across different countries are expected to be different.

The next section addresses the issue of drivers and barriers to the effective development of renewables, this is important since this allows for the identification of potential success factors and decision-making indicators and factors utilised by potential developers and investors.

2.3 Drivers and Barriers of Renewable Energy Development

Having looked at the development of renewables globally and identified the uneven levels of deployment, there is an underlining need to bridge the development gap. This need is further intensified by the potential benefits renewables offer in developing countries to facilitate transition towards the low carbon economy, since the energy systems in these countries can be restructured to lower their reliance and dependence on fossil fuel.

The ambition to transform the energy consumption landscape to reflect the principles of the low carbon economy is one that is considered paramount however there are challenges, barriers and drivers that hinder or facilitate these intentions.

In this section, drivers and barriers to RE development are considered at country level, the importance of this lies in the notion that effective and rapid deployment is hinged on the clear understanding of unique system and country requirements. The knowledge of these especially in the design of policy and decision-making for development of projects is essential.

The work of (Mondal, Kamp and Pachova 2010) targeting renewables in rural Bangladesh identified the main driver for the development of renewables to be meeting the basic lighting and cooking needs. Having identified the context of application it was identified that barriers to adoption of these solutions include fit-to-need, social acceptance, government and institutional support.

In the case of Nigeria, (Ohunakin et al. 2014) found the drivers for solar development to be resource availability, energy access and demand, and incentive based policy reforms established for renewable development. Barriers reported were variability in resource, grid availability, lack of awareness, high cost and government policies were mitigating factors hindering the development of renewables.

Lu et al. (2019) conducted a study to identify barriers and drivers for building integrated photovoltaic solutions in Singapore. Carbon emission correction, potential economic benefit and green certification were found to be the most influential drivers. On the other hand, factors inhibiting the development included high upfront cost, payback and low energy efficiency conversion rate. (Eleftheriadis and Anagnostopoulou 2015) carried out research identifying barriers to renewables development in Greece. The barriers classified as the most pressing were, inadequate financial resource, low grid capacity, planning permission delays, community opposition and unplanned changes in institutional framework.

(De Jongh, Ghoorah and Makina 2014) worked on the development of renewables in South Africa in the attempt to identify and understand drivers and barriers. Two drivers were highlighted, the need for political stability and energy security facilitated through the use of renewables and the potential renewables had in addressing basic energy needs.

High cost, dependency on foreign supply for technology, technology maturity and social acceptance are barriers to development. Finally, the work by (Sen and Ganguly 2017) was comprehensive, considering drivers and barriers across different countries. Drivers identified in the research were the need to secure energy access, potential socio-economic benefits and climate change mitigation while barriers included market failure, policy failure and institutional concerns.

From the above review, drivers and barriers can be classified as decision factors necessary for consideration before any attempt to develop renewables is embarked upon. It is critical to understand these factors and their influence on development effort if effective deployment and diffusion is to be achieved, failing to effectively address heightens the risks associated with the project.

In the country cases considered above, cost and funding concerns, policy, community acceptance, technology and knowledge gap, bureaucratic and institutional concerns were reoccurring. After careful consideration of these factors, they have been classified in to top-level categories namely, financial/economical, technical, regulatory/political, institutional, environmental and socio-economic. These top categories can be sub-categorized into investment or development success factors or indicators that must be considered by the decision-maker. The consideration of these factors by the decision-maker is a lens through which potential risks associated with a project or investment can be identified. Having identified general potential factors critical for decision-making, it is important to consider the role of specific country effects.

Three major points are raised here. Firstly, although the factors or indicators identified above are reoccurring and prevalent across the cases in literature, it is plausible to associate country and actor difference to decision factor prioritization, Here actor refers to the varying group of participants within the sector, developers, policy makers and regulators. Secondly, renewable energy projects are known to be risky in light of the barriers identified, however research categorising risks by country and actor preference has been lacking especially for developing countries.

Finally, with the electricity market system been diverse with different actors and interests, it becomes essential to understand the reason and motivation for their participation. In understanding the motivation of firms, there is a need to explore the theory of the firm discussed in Chapter 3. This theoretical dimension considers a firm as a collection of actors with interests that have to be met through engagement in the business environment in this case the electricity market.

In this section, the potential decision-making factors have been identified from literature and categorised into top-level categories. The natural transition after identifying the drivers and barriers to renewables is the definition of diffusion strategies or approaches, which will aid the deployment of these solutions. Consequently, the next section discusses diffusion theory in general and focuses on its application in renewable development. The underlining intention is to identify the key components that facilitate diffusion process.

2.4 Renewable Development and Diffusion

In the previous section, 5 top-level categories with sub-factors were itemized as critical to facilitating the development of renewables. Despite the knowledge of these elements, the development and deployment figures has yet to be significantly improved in certain parts of the globe especially in Africa. For this reason the study of diffusion as it relates to deployment of renewables is critical. Renewable energy solutions are radically different from their conventional counterparts, rightly classified as innovative and disruptive with need of effective diffusion mechanism.

Diffusion as a concept follows the idea that an innovation (product or process) requires a systematic method for its full acceptance and adoption within a system. In terms of approaches the diffusion of innovation by Rogers has formed a significant part of modern diffusion theory. Rogers defined diffusion as a process of communicating innovation through channels over time among actors in a social system (Rogers 2003). The key components as identified by Rogers were an innovative idea or solution, a communication channel or channels, actors and a social system. His approach highlights as well the categorisation of the types of actors as it relates to perception of the innovation.

Building on this, was the work on diffusion theory of advantage, which particularises the incentive that facilitates diffusion (Greve 2009; Atkin, Hunt and Lee 2015). This perspective places focus on the property of the innovation in the case of a technology, advantage lies in the quality and potential effects.

Diffusion research in renewables highlights the progressive adoption of technology centric solution within the electricity system, which has developed a high level of path dependency. The challenge is developing approaches that manage the resistance presented by the already established electricity market system.

Jacobsson and Johnson (2000) research is far reaching in terms of developing a system to understand the diffusion process. It covered 4 distinct renewable energy options and also developed a framework that explains the diffusion process. Within the framework are 3 elements (actors and markets, networks and institutions) that represent the system for which a diffusion mechanism must take cognizance of for it to be effective. This system approach simplifies the analysis of the diffusion process by compartmentalising concerns associated with the different interacting system element.

Mignon and Bergek (2016) developed a system and actor framework that was used to identify challenges to the process of diffusion in two countries (France and Sweden). The findings indicated that the national context within which a solution is targeted for deployment strongly influences the type and nature of challenges faced and invariably the design of a diffusion approach. This compliments the earlier position discussed about the country diversity dimension and its potential effect on diffusion.

The research focus on technology and policy factors that contribute to the diffusion process of renewables is significant. Popp, Hascic and Medhi (2011) looked at diffusion from the policy and technology interaction perspective stating that although renewables present opportunities to the investor, the choice of what can be classified as new renewables such as wind, solar, geothermal and biomass struggles to compete with other clean energy sources such as nuclear and hydro. In this instance the availability of alternative technology was not enough to drive the needed diffusion required, making design of appropriate policy support very important. Karneyeva and Wustenhagen (2017) looked at diffusion from the investors' perspective considering policy driven support and its effect on correcting risk and expected performance. Essentially a distinction was made between support and their potential effectiveness, which is predicated on design. Foxon and Pearson (2007) also looked at the effect of policy on the promotion of diffusion of innovative technology. The approach in this case looked at the system dimension considering the role of actors in facilitating the generation of new solutions and its effective dissemination through networks and communication channels. These cases show the reoccurring importance of technology and policy synergy. Finally two national cases are considered, the work of Eder, Mutsaerts and Sriwannawit (2015) addressed the issue of diffusion of electricity using the mini-grid in Uganda. This work explored viability by identifying the factors of function, funding and earning capacity as worthy elements to consider especially for foreign firms interested in that market. A European perspective was considered with the introduction of biogas for transport in two cities where the diffusion and viability relationship were hinged on the signals from political actors, potential consumers and existing market structure (Fenton and Kanda 2017). System perspective, technology and policy tend to be reoccurring themes within the diffusion literature. Therefore, in the next section technology and policy interaction will be discussed as they facilitate the interaction between the systems and the actors.

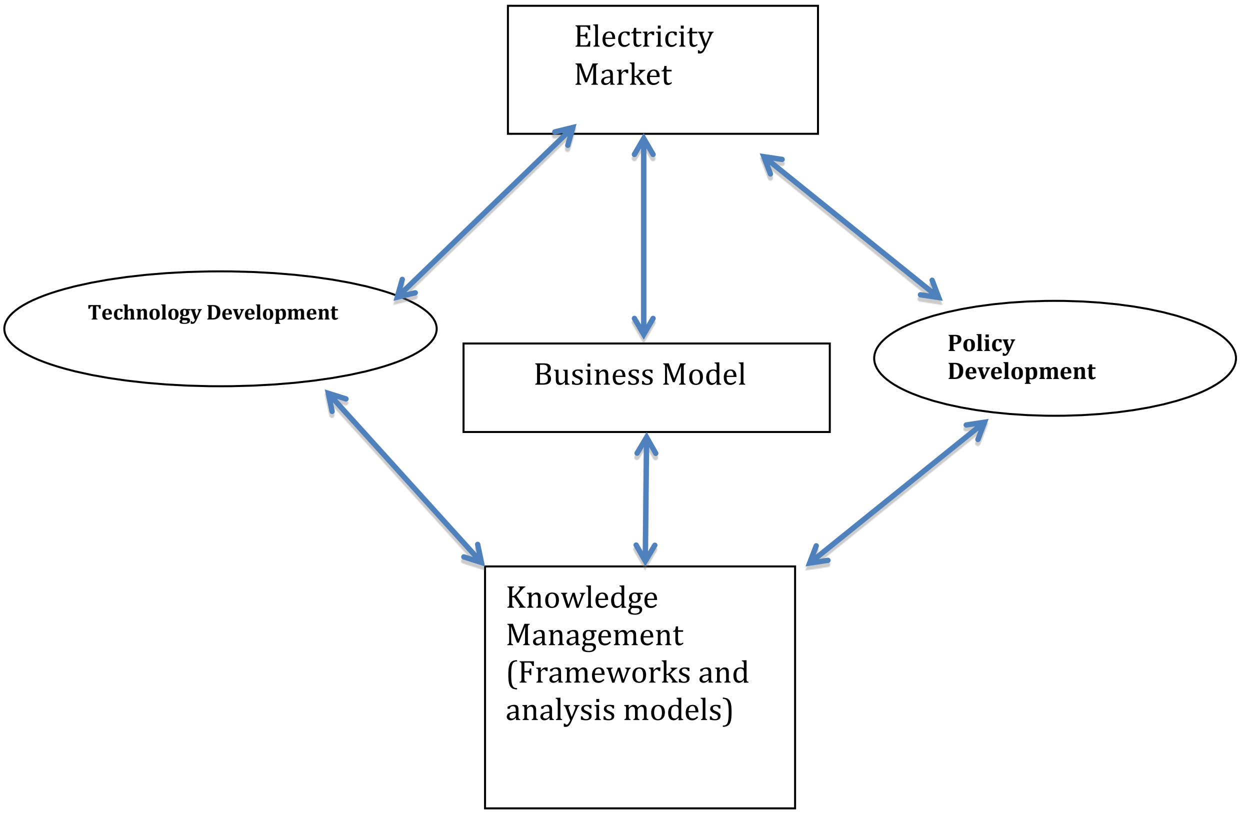
2.4.1 Diffusion Pathway (Technology and Policy Interaction)

The diffusion pathway for renewables is characterized by the interaction between different elements of which technology and policy are most noticeable (Foxon, Hammond and Pearson 2010; Fenton and Kanda 2017).

These two components facilitate the choices of utility companies and independent developers that represent a segment of the market actors in RES development. The development and standardisation of generating technologies is directly influenced by the presence of a market need as it is for any innovation. The arrow as shown in the Figure 2.4 below indicates that communication between technology developers and suppliers must exist with the market. However, the standardization of these technologies is facilitated by policy intervention especially in the cases where they are not cost competitive with substitutes. Essentially, the market generates the signals for adoption of technology if there is a need for one. Consequently, policy and technology represent the independent components. They directly influence choice on the basis of incentives they introduce. This is observed in the case of Germany, Denmark and the United Kingdom (Lipp 2007) and other countries that promote renewables.

The market and business models are shaped by firms' perception of the technologies and policy. The market's segment is the first layer of exposure to both components. A good example is the case of the electricity market. This has evolved with the introduction of renewables technology options facilitated by policy support as the arrows in Figure 2.3 indicate. This is a bi-directional exchange of feedback which acts as signal for the market. There is also a bi-directional feedback exchange between markets and the technology and policy component especially in the case of triggering and establishing need. Similarly, businesses depend on market signals, which aid in the redefining of their value delivery systems using innovative business models as the operational environment evolves. The different interactions are layered into knowledge management domain. Figure 2.4 below shows these interactions

Figure 2.4 Technology and Policy Interaction map for Renewable development



Source: Developed by the author from the literature

Since significant attention has been drawn towards technology and policy development, Martinot et al. (2002) suggested the need for a change in emphasis from technology and policy components to understanding the market since it houses the actors that engage in development activities. This is logical since diffusion of any form requires a social context, which in the case of the renewable sector facilitates the engagement between market players, policy developers and technology providers within a market environment. In this research the market context is an expression of the country specific characterisation, which reflects an operational, socio-cultural and institutional construct. This market domain can be further extended to capture the cross-country differences between developing and developing countries classified different markets at different levels of development.

This layer of diversity and its influence on diffusion from the perspective of transferring experiences across market is a gap that is addressed in this research.

The cross-country analysis will focus on Nigeria and the United Kingdom representing developing and developed countries respectively. This comparison is interesting because both countries share certain similarities and differences. Both countries operate a deregulated electricity market with multiple actors participating, which is ideally a depiction of market-driven system and a basis of competition. However, Nigeria's electricity market is at its infancy stage with respect to its electricity market as it was deregulated in 2008 as compared to the UK, which has been deregulated since 1990. In terms of institutional framework the UK has gone through cycles of changes to its current 'Contract for Difference' which is a competitive market-based scheme for large–scale renewables (Bunn and Yusupov 2015). Nigeria has a framework that guarantees the entry for different classes of developers and provides financial guarantees for production (Emodi and Ebele 2016; Eni and Akinbami 2016). Both countries have explicit targets for renewable generation as such are committed to the development and diffusion of these solutions. This diversity in market and the earlier identified diversity in actors can be explored for insights in the areas of identifying decision factors and risk prioritization when decision-making process is examined. The definition and identification of decision factors and risk association is an essential part of the decision making process for any kind of development and more so when implementing effective diffusion. This is discussed as it relates to existing renewable energy research in the next section.

2.5 Decision Making and Assessment of Viability of Renewable Solutions

The development and deployment of RES is a process that is time consuming, resource and cost intensive, therefore as part of the process of establishing the validity of a choice has to involve decision-making.

The research direction for decision-making for renewables focuses on the assessment of technology options (Strantzali and Aravossis 2016; Wang et al. 2009) as compared to the overall review of process from inception to final investment decision. This lack of research creates a gap in theory and in practise.

The theoretical perspective as shown in literature points to adoption of rational approach with clear objectives and predefined methods and assessment tools (Strantzali and Aravossis 2016) . There has been significant amount of research on technology assessment where potential technology solutions are compared (Amir and Diam 2012; Adam et al. 2016; Byrnes et al. 2016; Diemuodeke et al. 2016). Resource availability assessment, where availability is matched against energy need (Al Garni et al. 2016; Prasad et al. 2017). Sustainability assessment where solutions are compared on their ability to deliver on the triple bottom line while managing impact and finally on assessment as it applies to context of use cases some of which are community, household and hotel electrification (Hadian and Madani 2015; Afonso and Rocha 2016; Atilgan and Azapagic 2016; Puig et al. 2017). In these varying modes through which assessment has been conducted there has been the emergence of tools and frameworks addressing issues of impact (Life cycle analysis), diversity in interest and participants (Multi-criteria analysis) and the more popular techno-economic analysis (Mardani et al. 2015; Strantzali and Aravossis 2016). The above represents the current direction of research, which looks at decision making as purely rational with clearly defined objectives and information. This direction fails to capture the influence of decision maker behaviour preference and market context on the decision-making process.

In addition, the scenario of diffusion implies uncertainty and change, making the appropriateness of the rational approach as suggested (Mignon and Bergek 2016; Hall, Foxon and Bolton 2017; Liu et al. 2017) questionable.

In practice the establishment of a decision to implement a project is built on the organisational perspective of project viability. The representation of viability as captured in literature has not fully captured the developer's perspective using the system analysis. The system-based approach is one that has been found to be useful especially if interactions within a system are to be accounted for (Hadian and Madani, 2015; Rebs, Brandenburg and Seuring 2018; Fontes and Freires 2018). Consequently, establishing the viability of a project should involve the consideration of the potential variety of interest across developers while taking account of the potential influence of their market of operation. Here the market is a representation of the need, social institutional and infrastructural state of the operational environment, which potentially influences the decision-making process.

Adopting a system-based approach to establishing viability is suggested against the traditional approaches that focus on technology or application scenarios without focusing on the developer's perspective.

This gap in the current decision-making research for renewables presents two key opportunities. In the previous section, the country or market effect was mentioned as influential on the diffusion process. Since decision-making is critical to the diffusion process, it is plausible to assume that country and market effects could also affect the decision making process. Hence, there is a need to know how decisions are made to identify potential effects.

Secondly, the existing theoretical positions have the rational organisational decision model as the representation of how decisions are to be made (Haralambopoulos and Polatidis 2003; Strantzali and Aravossis 2016). However research has shown that under uncertainty and risk driven conditions the decision-making behaviour deviates which epitomizes the decision making in the renewables sector (Canejo, Carrion and Morales 2010). This research explores the appropriateness of that theoretical position.

In this research the state of decision-making processes as it applies to renewables is explored. The second point is also linked to decision-making but captures the elements of diversity (country and actor preference) as it relates to the establishment of viability. A framework is suggested that addresses these elements of diversity in the process of decision-making particularly at the diagnostic stage. The diagnostic or prefeasibility stage is the stage where the firm attempts to establish if a prospect is worth investing development capital on.

Since it has been observed that country and actor effects could influence the nature of the process, it is also plausible that these conditions especially actors preference could shape the measures of viability.

This is practically relevant especially in developing countries seeking to attract developers and investors from more developed systems. Exploring their decision-making requirements adopted by developed counterparts offers an insight into decision factors and their prioritisation at the early stage of the process. Since this is the stage that shapes the interest of a developer or an investor to inject money on the further development of a potential prospect.

There is a possibility that the current decision making and viability assessment approaches in transitioning market conditions may be inadequate as they are likely to fail in capturing the interest associated with the current state of the market, making the system analysis approach useful.

2.6 Summary

The review establishes the foundation for the development of renewables in the need to tackle energy security and the climate change challenge. In the attempt to achieving this there is an overarching interest to transform the energy system to be less dependent on carbon-based fuels by developing low carbon economies. This transition relies on the use of renewables as one of its approaches amongst other but the development of renewables although laudable is plagued by challenges. These challenges introduce risks that affect the effective diffusion of RES. These risks shape the choices that developers of the potential solutions have to make. Using the diffusion theory concept of the social system comprising of actor with varying interest, there arises the question of risk perception and risk association that emanates with this extent of diversity. The first question raised in this research focuses on risk and sustainability from the developer's perspective.

The developers' view of risk and sustainability has a direct impact on the assessment of project viability. It was mentioned earlier that actors have varying interest; therefore it is plausible to say that the objective of these groups will differ and potentially influence their viability assessment approach. In addition, these development projects are implemented in different markets representing different operating conditions. Therefore viability assessment should consider developer preference while capturing the influence of market. For this reason the second question points to the need for an alternative viability assessment approach that considers development of renewables from the system perspective as seen by the developer.

Finally, it was mentioned that development of renewables occurs in different market characterised by different needs, institutional and infrastructural provisions. These markets undergo change through the introduction of policy and infrastructural improvements. These transitions can be considered to be positive or negative depending on the developer’s perspective. Market transition implies change, which has the potential to influence the nature of decision-making process as adopted by developers. On this the third question of this research is founded.

The review as stated above leads to the generation of three fundamental research questions.

1. What is the link between risk and sustainability from the developers’ perspective?
2. What system-based approaches can be adopted in the definition of viability assessment standard for developers?
3. How does the transition affect the market and process of decision-making?

In the next chapter, these ideas are further developed using theories that describe the interest of the firm and decision-making as well as viability assessment frameworks.

CHAPTER 3 THEORITICAL FRAMEWORK

3.1 Introduction

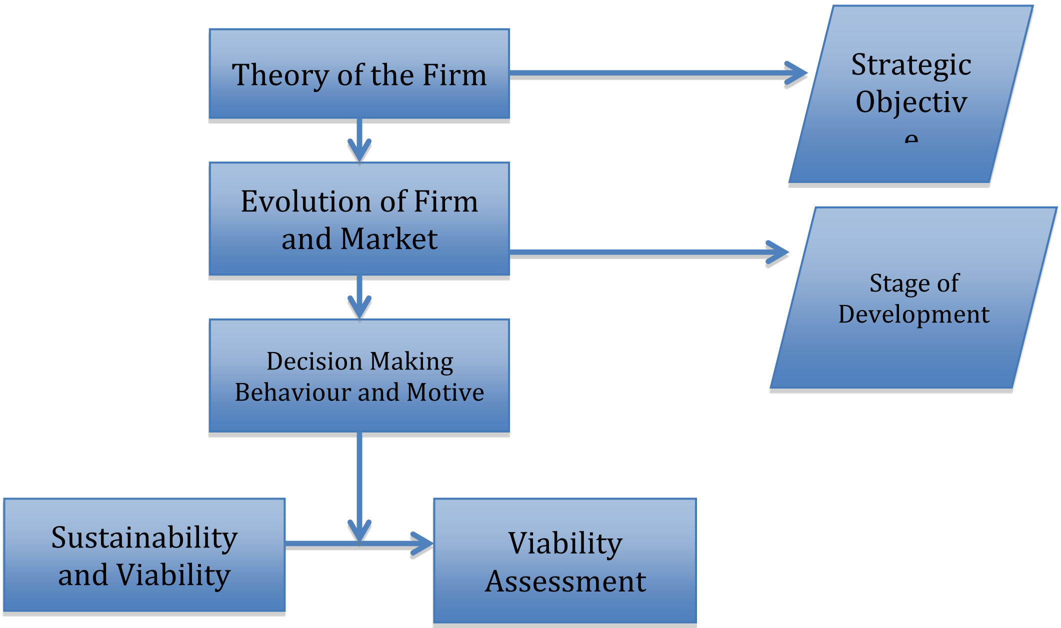
In Chapter 2, the need to address the energy security and climate change issue was linked to the accelerated rate of renewable energy development. It was also shown that the development of renewables requires technological innovation triggered by the interaction of factors within a social system as represented by the concept of diffusion. In addition to technology and policy, the market and actor factors were identified as influential to the process of diffusion. Also emanating from the chapter was the relevance and potential value in adopting the system-based approach for analysis of problems.

Since diffusion serves as the channel through which development of renewables is accelerated. The associated change it introduces is assumed as having the potential of shaping the energy market, risk perception, decision-making process (DMP) and developer's strategy. Also from the previous chapter, an analogy was made that associated factors required for decision-making with barriers and drivers of renewable energy development, it was suggested that these factors potentially could vary across different markets and developer class. In this case, risk perception can be associated with the decision-factors prioritized by a particular developer, which points to the organisations interest.

In order to fully address the questions raised in Chapter 2, a theoretical framework was developed as shown in Figure 3.1, that addresses a firms interest, the change process associated with diffusion and development of a renewable project and finally the challenge of decision-making.

The figure highlights the interaction between theories and concepts, starting with the conceptualization of the theory of the firm, which serves as a medium for understanding the firm on a structural and functional basis. In implementing and achieving organisational objectives, decision-making is paramount therefore decision-making is also addressed in this chapter. Finally, in executing decisions of any development effort, there is the need to assess the viability. Having earlier indicated the potential in solving problems using the system approach, a viability assessment framework to be applied by firms is proposed.

FIGURE 3.1 Theoretical Framework



Source: Developed by the author from the literature

Byrne and Taminiau (2016 p.1) stated "strategies that guided development throughout the 20th century relied heavily on economic optimization as a chief guiding principle in the design of energy, technology, markets and policy". The above statement epitomises the philosophy of operations as adopted by organizations. This philosophy places emphasis on optimization and maximization of returns, which is the ethos of most profit-driven organizations saddled with the task of delivering profit to their shareholders. In retrospect this desire for profit, the limited concern for resource use and its impact has been attributed to being partly responsible for the declining environmental resilience evidenced through climate change (Elijido-Ten and E.O 2017). Hence the consideration of alternative routes for processing while meeting the core objective of the firm becomes relevant as advocated by sustainability practitioners (Ginley and Cahen 2011; Shoubi et al. 2015). Sustainability may have different representation depending on interest considered, however a general consensus focused on achieving the triple bottom line objectives of economic, environmental and social performance (Elkington 1999) has been advocated. The challenge of meeting these sustainable outcomes is heightened when there is a diverse array of sector actors involved as is noticed in the development of renewable solutions. This diversity translates into variety in actor interest; policy makers are constantly involved in designing and refining regulations that support the diffusion of different technology options while controlling their cost of support. Utilities focus on securing returns for stakeholders through investment and development while complying with regulations. Finally, independent generators deal with choosing between different available solutions that deliver optimum economic value. These varying interests as highlighted indicate the need for an alternative approach for analysis that reflects the different actor interest. It has to be one that goes beyond focus on economic optimization, single objective approach and captures the system dimension (Fiksel 2006). In other to address the issue of interest and firm objective, the theory of the firm is analysed.

3.2 Theory of the Firm (Strategy Position)

The fundamental objective of firms is delivering value to stakeholders through competition as they execute deals and contracts while maintaining relationships (Anand and Khanna 2000; Hallward-Driemeier and Pritchett 2015). Over the years the theory of the firm has grown as an area of research to cover a vast range of concerns that deal with the interaction within and outside the firm. Holmstrom and Tirole (1989) placed the theory of the firm into two broad categories, principal agent or the incomplete contracting approach, identifying the need for incentives as the foundation for the principal-agent approach. However, the study of relationship between stakeholders is captured with the incomplete contracting approach, which relates to decision-making as well as people participation. On the other hand, McWilliams and Siegel (2001), Scherer and Palazzo (2011) considered the theory of the firm from a responsive perspective where justification of corporate social responsibility (CSR) actions is hinged on its derived cost and benefit to the firm. In these instances the duty of the firm as a part of society is to meet its social obligation through actions considered as adding value to society while delivering long-term economic value. As profit driven entities, the choice of CSR and how much it involves is a concern for firms. Studies have shown both negative and positive outcomes have been recorded in the relationship between CSR and financial performance (Flammer 2015). The choice of financial performance as the indicator of viability and the measure of CSR fits the standard accounting reporting framework, understood by external and internal stakeholders. Other dimensions of the theory of the firm have also been suggested, Zingales (2017) considered the firm as political machinery, which outside its interest in securing economic gain also invests in securing legitimacy in the political space. This is quite pronounced in the energy landscape with the resistance displayed by oil major to the entry of renewables into the energy space in the early days. However, the constraints on production and carbon emission targets on nations around the world and the fear of been left behind has spurred their participation in the industry. The likes of British

Petroleum and Shell have moved into investing in renewables and other low carbon options like electric vehicles (Matt 2018). Although this shift is considered necessary, developing renewables have been associated with high investment cost as compared to their conventional alternatives. This shift raises the question about incentive, if profit maximization is assumed to be the core driver for firms. This forced adjustments to the irresistible effect of innovation by firm towards renewables leads to another dimension of the theory of the firm worth considering, which is about capability. Teece (2019) looked at research on the theory of the firm from the perspective of capabilities, stating that the transaction cost and agency approach place excessive relevance on the economic incentive. Consequently, undermining the role of unique firm capabilities, which forms the actual sources of advantage that drives economic returns. Regardless of these varying perspective, the profit maximization point of view forms the underlining motive to the question of why firms exist and addresses the issue of how they engage in exchanges of value.

Exploring a bit further, the profit maximization position is grounded in the ability of a firm to correct its transaction cost. The work by Coase (1995) addressed the fundamental question of why firms exist which is the notion of transaction cost. This fundamental concept is the distinguishing factor between firms and individuals in the way exchanges are justified. This essentially is reflected in the firm's business strategy. While the price system defines the basis of exchange between individual and firms, firms tend to exist solely if the transaction cost as captured within the price system is effective and efficient. Essentially, firms consider prices but more importantly seek for an advantage that lowers transaction cost (McIvor 2009;Ketokivi and Mahoney 2016).

So, for a firm engaging in electricity generation the underlining motive is ensuring that transaction cost is lowered, how this is achievable using renewables has to be effectively addressed through the appropriate strategy. Finally, consideration of profit-maximization as the motive for firms is the underlining theme that has shaped the varying directions taken in the research around the theory of the firm. This position of profit maximization is operationalized in the neo-classical approach as it applies to the firm engaged in renewable development, which is discussed below.

3.2.1 The Neo-classical Approach

Since the basis of choice to develop a product or project is hinged on the price of production systems and the incentive to stay competitive. Firms rely on the least cost approach to deliver value to their clients while maximizing the profits for shareholders. The development of renewable energy solutions especially for utilities whose business model depends on the price approach is challenged. The neo-classical approach thrives on the establishment of competitive advantage through the delivery of value using easily accessible resources at least cost (Jacobs 2013). Therefore, business depends on proximity to cheapest resource and manpower, which reduces cost of production while lowering the price points on goods or services produced. The same translates to the power generation sector, which through time has been powered mostly using coal, nuclear and hydropower both natural resources with cost effective technologies (Borenstein 2012). These established systems within the electricity and power generation sectors naturally resist the motion towards change in the status quo (Geels 2012). Any introduced change has the potential of increasing production cost while exposing utilities to uncertainties never considered under the neo-classical approach. It is apparent that the neo-classical approach was conceived without the valuation of long-term impact and potential externalities (Jacobs 2013). This value gap is not fully captured using economic and financial indicators, which symbolises the conventional viability approach. Therefore necessitating the incorporation of the triple-bottom line approach, that considers system wide factors and measures of performance. The adoption of the triple bottom line approach captures elements of sustainability into the conventional viability consideration as applied now for renewable energy projects. Here two value perspectives will be analysed, the sustainability perspective and the strategy perspective. The sustainability dimension as applied in the delivery of renewable energy projects seeks to achieve the four major objectives economic, social, environmental and technical viability on a project level. The focus here will be on the effectively capturing the social and environmental dimensions as it applies in the Nigeria RE development space since the economic and technical dimensions are mostly addressed in the existing viability assessment approaches (Ngala, Alkali and Aji 2007;Adaramola 2014).

The electricity reform in Nigeria is one of those instances indicating the move towards sustainability with the interest in developing renewables. Consequently, facilitating the emergence of local firms and the entry of international firms. Having established earlier that the least-cost approach is the guiding principle in the neoclassical approach, justifying the sustainability and viability of any renewable energy projects becomes very critical.

Due to the capital-intensive nature of renewable projects, most indigenous and foreign developers are required to raise capital and meet guidelines as stipulated by potential funding bodies. As part of those guidelines for accessing finance, the implementation of a comprehensive environmental and social impact assessment (ESIA) is required.

Therefore, it is a mandatory requirement for all prospective developers, experienced foreign developers and local engaged in the renewable energy sector. The report captures the immediate and future impact of a proposed project on the lives and livelihood of the host communities with remediation propositions. The Nigerian Electricity Regulatory Commission (NERC) also requires the ESIA report to be presented by prospective developers before licences can be offered. This balance between profit and non-profit based values reflects the sustainability position enforced through regulatory agencies.

In terms of the strategic position, the firms both local and foreign seek to secure an early share of the market and establish a first mover advantage by adopting the use of proven technologies. Due to the origin of these firms, there is a further distinction in terms of experience and expertise, which will reflect in their development and decision-making process. The Nigerian firms take up the full ownership or equity approach with the opportunity for knowledge and technology transfer in the areas of procurement and development respectively. From a strategic standpoint, it is plausible to categorise foreign and local firms that engage in an electricity market like that of Nigeria which is riddled with uncertainty as risk seeking as such will be profit driven. Although the profit driven agenda established as the potential strategy direction reflects the interest of developers, its effective implementation has to take cognisance of the unique influence of the operational environment as this shapes the strategic and process dimensions adopted by the firms.

3.3 Change and Influence of Operational Environment

The work on diffusion theory and processes in Chapter 2 is built around introducing innovative technology that will lead to change in the market landscape. The term market as utilized in this research refers to the electricity market, which is a social system composed of stakeholders, institutions and processes. In this research, the change associated with the market signifies potential change in operation and process, as well as the emergence of new stakeholders.

The global electricity market has undergone some structural change, moving from state-owned institutions basically monopolies in most countries to a more liberalised deregulated market as currently noticed in the UK and Nigeria (Chang and Lee 2008; Olugbenga et al. 2013). The UK restructured its electricity market in 1990 initiating the deregulation of the sector by making it a market driven system with the emphasis on competition amongst market players (Salies and Price 2004). Another dimension of change as noticed in the UK electricity space was the attempt to address energy security and climate change by introducing renewables into its electricity mix. The introduction of renewables necessitated the need for the adoption of new technology, development of support policy and adjustment in operations of the electricity grid (Stenzel and Frenzel 2008). These changes were resisted initially since there was a gap in knowledge and lock-in within the energy system for conventional fuels had been established. Decision-makers grappled with adopting these newly commercialised solutions in the early 2000's and are still faced with these challenges now because it alters the existing energy generation pathway. This translates into need for new resources, competencies and introduces uncertainty in the value delivery pathway, which could lead to loss in profits. Consequently, government introduced policies and strategies to facilitate this transition. Currently the renewable energy market in the UK is diverse with the participation of already existing utilities and the emergence of new firms interested in the development of small and large-scale renewables.

Similarly, changes have been noticed in the Nigerian electricity space with the enactment of the electricity reform act 2005, pioneering the deregulation of the Nigerian electricity market in 2008. In 2015 the National Renewable Energy and Energy Efficiency Policy was passed signalling the commitment for development of renewables alongside support policies that lower risk exposure of potential developers (Anwana and Akpan 2016). This also translated to the emergence of local independent power producers and the participation of foreign development partners. The detailed review of the UK and Nigeria electricity market is a reflection of markets at different stages of development. The UK started out with investing in research and development in technology and moved on to a support driven market system to promote entry of established technologies by correcting cost through subsidies. It is now transitioning into the market driven system where competition on cost separates the participants in the market. On the other hand, Nigeria is lacking in areas of research and development in technology, therefore dependent on technology options from outside her shores. The National Electricity Regulatory Commission identified the current stage of the Nigerian electricity market as been in the transitional stage characterised by unbundled service, contract based transactions and more formalized market structure (Nigerian Electricity Regulatory Commission 2014). Essentially this epitomises the change, diffusion has introduced in both country and market dimension. On this basis it is worth analysing adopted strategies and the decision-making process as it applies to the firms. In the next section, the stage of development dimension is discussed from the perspective of the firm as this forms the framework through which decisions are observed and analysed.

3.3.1 Stage of Development and Firm Characterisation

The logical starting point of organizational evolution is the creation of a new firm (Tushman and Romanelli 2008). The evolution of the firm is an idea of incremental change across processes, patterns and leadership. Durand (2006) stated that companies adopt a life cycle pattern from their creation to decline with different explanations accounting for the varying paths that they take. However, with the diverse nature of firms within the renewable energy development space, the stage of development forms a framework through which markets and firms can be characterised and linked to their associated strategy and processes. The work by Baird and Meshoulam (1988) acknowledged the presence of five kinds of models of organizational growth, hierarchical, evolutionary, life cycle, metamorphosis and stage model. The life cycle, evolutionary and hierarchical models suggest that different growth dimensions are predictable as such have known building blocks and paths. In addition, the stage and metamorphosis models are sequential but reactive to the environmental factors. The work by Lester, Parnell and Carraher (2003) used the five stages; existence, survival, success, renewal and decline to represent a firm's evolution. These different stages depict potential market entry point and can be associated with market stages of development.

The expansion of the electricity market into adopting renewables has introduced a broad range of players with different characterizations. The early adopters in the 5-stage model as shown in Table 3.1 describe the entrepreneur whose sole interest is to exist in the market, responsible for pioneering new solutions. The Private investor and utilities as captured within the model are those that are keen on success and as such seek stable formalized systems. This characterization aids the process of identifying firms and characterising stages of market development.

TABLE 3.1 Stages of Organizational/Firm Evolution

Stages	Internal Characterization	External Characterization
Existence	Process and Business Model Creation	First Movers, Entrepreneurs, Venture Capitalist
Survival	Business Model Verification Developing Competencies and processes	Venture Capitalist
Success	Standardization of process and protocols	Established Firms
Renewal	Innovation on processes and protocols	Established and Small Firms
Decline	Process Slack and Lock-in	Established Firms

Source: Lester, Parnell and Carraher, 2003 P. 347

Table 3.1 above is a representation of the internal and external characterization of firms in the different stages of development as identified by Lester, Parnell and Carraher (2003). Drawing from the representations as shown in Table 3.1, features characterised by these stages of development can be associated with the type of firms that take up renewable projects. The emergence of different market actors in the renewable energy sectors for example in the UK and Germany are a clear indication of this diversity. In the UK for instance, the big 6 comprising of the British Gas, Scottish Power, Scottish and Southern Energy, Npower, Eon and EDF once dominated the market. These companies were strategically positioned as vertically integrated with the interest to meet customer demand by delivering affordable electricity to consumers from sources such as coal, nuclear and hydro which are cost effective and established solutions. Only recently has renewables penetrated their portfolio altering the electricity value chain of these firms. This penetration has led to a wider change in the market with the rise in participation of independent power producers, solely exploiting renewables. In the Nigerian case, the deregulation of the electricity sector paved a way for the establishment of independent generation and distribution companies respectively. Since the incumbent generating companies mainly rely on gas and hydro and the emerging companies seek to deploy renewables, there is a discontinuity in experience and need for expertise in this new area. In the areas of delivering electricity, the lack of integration ultimately differentiates utilities from IPP's strategically. A firm developing just generation capacity with guaranteed hedge for risk is positioned to maximize returns even in the absence of an effective supply and transmission channel; this is the case for the Nigerian developers. The developers in Nigeria are focused on generation for the purpose of profit generation; this is similar to the independent power developers in the UK. The vertically integrated developers in the UK are focused on customer satisfaction since generation to them is not unconnected from the electricity supply to consumers. Using the above it is clear to see that vertically integrated developers in the UK will be sceptical considering their ethos and strategic goal to participate in the less developed market due to the uncertainties it presents.

The above scenario portrays the need to consider the potential effects of different market stages and firm characterisations as it relates to varying risks, opportunities and strategic purpose of firms. On this note, the proposition that the market cycle of development has the tendency to shape a firms strategy and organisational objectives is founded. Consequently, assessing performance has to take into cognisance the role of the firm's stage of market development. This builds into the first and third research question, which looks at the risk and sustainability dimensions from the developer's perspective while advocating for the need for revaluation of the viability assessment tools addressed in the Section 3.5. Having discussed the firms and market as entities prone to change, with their stages of development impacting on their strategies, it is important also to consider the instruments through which they deliver value. Since it is also plausible that these instruments are exposed to influences of the operating environment. The instruments are the processes and products utilized in the course of renewable energy development. The change dimension as it relates to process and product is discussed in the next section, which represents the firm's value delivery mechanism needed for achieving any firm objective.

3.3.2 Process and Product Change and Evolution

Firms evolve so do their systems and instruments for value delivery, particularly products and processes. The electricity market has been found to evolve in its processes and products; the market dictates the changes in process and products either through cost correction, regulations or consumer demand (Kjellberg et al. 2015). Regulations within the electricity generation market have placed restrictions on utilities to account for a percentage of their production from renewables. Similarly, the annual drop in the cost of production using renewables presents a solid business case for the expansion of developers green portfolio. Finally the potential benefit of self-generation is moving the ownership and control to the consumers. These incentives make the argument for adopting renewables sound both from the economic, environmental and social standpoint. However, the process of adoption requires the introduction of new products and the processes. These products and processes are likely to be influenced by the changing market condition and operating environment, these build into the third research question. The work of Utterback and Abernathy (1975) is a representation of the life cycle of product and process as adopted for this research. These life cycle stages can be applied to organisations as it represents change in instruments through which value is delivered but also a reflection of their strategies; here process and product change is assumed to facilitate improved productivity considered to be vehicle for value-delivery. The notion is that for improved productivity, processes must evolve leading to the effective use of resources and time. Utterback and Abernathy (1975) identified three different process stages, suggesting that processes should be characterised by the their cumulative incremental nature represented in these three process forms (uncoordinated, segmental and systematic). These different stages of process change are delineated by control and coordination. These stages can be associated to the context of market and actor diversity. The instance of a market in its infancy is one, which will be lacking processes since there is a clear lack in knowledge of what makes a process and absence in procedures. However, it changes with learning and becomes more sophisticated with time that is a depiction of the renewable energy market. Similarly in terms of operation, a firm in its infancy will be less systematic in its process since it lacks experience and competency to build and implement processes and procedures, however this changes with experience and growth in a firm as is noticed in vertically integrated utilities. The systematic representation being the most sophisticated in terms of control and coordination is associated with the most developed firms and markets.

Utterback and Abernathy (1975) adopted a similar approach for the development of products. Since product development occurs in leaps that are both connected and unconnected to product predecessors. This approach is considered important since an association can be established between firm, nature of products and their market of operation. In addition, the product evolution is targeting functional improvement and strategic intent, the stages suggested were performance maximizing, sales maximizing and cost minimizing. Therefore, product change is associated to level of maturity and strategic value. The product and process representations are critical in the analogy utilised in the description of markets and firms. Since products and processes reflect the value delivery pathway of a firm and its market, it portrays the level of maturity associated to both firm and market.

Firms that focus on performance maximization are entrepreneurial, mostly leading innovations and therefore exposed to the highest level of uncertainty. This stage is flexible with potential variation in technology and process indicating the absence of a stable market conditions; in addition, there is an immense dependence on external information. Those in the sale maximizing stage are interested in gaining market visibility, which is attained through product differentiation. The development of basic performance requirement in the first stage reduces the level of uncertainty both for technology adopters and consumers of products at this stage. The major interest of firms in this stage is gaining and securing loyalty while building some form of standardization. This represents the stage of entry for most utilities, as they prefer established technologies that fit into their existing production process. In this stage it can be argued that a market has been formed and is emerging. The case of Chevron and Exxon is a clear depiction of how the operating environment could influence the choice of firms to engage in a market. Both firms holding back on development in renewables points to their perception of risk associated with the market in general. However, from the product perspective these companies are concerned about the changing state of technology, which is out of their control exposing them to unforeseen uncertainty and risks. This is quite different from their areas of core speciality (Matt 2018). On the contrary, companies like British Petroleum and Shell, although not pure power utility companies are ahead of the curve as they have engaged in the renewables market by investing in technology and electric vehicles and acquiring renewable technology companies, which means they can own the technologies and move with development in the sector (Quartz, 2019). Companies like Shell and British Petroleum can be classified as adopting the sales maximizing strategy. With the establishment of technological soundness of solution and substantial market gap to be filled by electric vehicles, they have adjusted their business models in line with the opportunity while consciously hedging their fossil fuel empires. Finally, the cost minimizing stage captures the achievement of standardization in product and process. The difference between firms is achieved through efficiency in production systems since the products across competing firms has been standardized so is the market. Uncertainties in this stage can be detrimental to the firm as it has the potential of altering the entire production structure. For process and product evolution the three (3) stages share similarities of incremental change, increasing maturity and decreasing uncertainty. These different stages of development across firms and their internal processes introduce a fundamental contextual basis for defining motives and drivers of actions within these different stages.

Since the neoclassical approach for firms is established on the premise that firms are focused on profit maximization. The three strategic dimensions suggested above, fault the single objective approach as advocated by the neoclassical school of thought. It also points to the potential for evolution in strategic intent depending on the level of development of a firm and its market position. Since the firm and market stage of development defines its processes and products, an array of factors, which are predicted by the time, and current location of a firm within its life cycle of development determines its strategic interest. The strategic interest shapes organizational structure, intention and processes; it directs the flow of resources and control while shaping the organizational expectation. Fundamentally it shapes the direction of firm's processes as such the argument that stage of development defines the strategic objective of a firm at every stage in its life cycle is raised. Consequently, if different stages of development have different strategic objectives it implies different risks and uncertainties as well as different approaches to achieving those objectives. This research therefore argues that for renewable energy markets are at different stages of development across geographies. Interested market players have different strategic objectives as such will require significant adjustment in processes for deciding on investment choice. On this premise it is plausible to propose that method and process of decision-making will be unique across different firms and markets of interest. Essentially the stage of development will influence decision-making process approach. This reiterates the second and third research questions that are highlighted in

Chapter 2. Having identified the relevance and place of decision-making process, it is therefore important to address the potential dimensions likely to be influenced by these changes discussed.

3.4 Decision-making (Environmental Influence)

The point was made in the previous section that processes that deliver firms strategic objectives are likely to be shaped by the firm's current stage of development. These objectives are achieved after series of consultations that lead to decisions (Cyert and March 1963). The business of decision-making is one complex part of the management practise that reflects the role and influence of the environment and actors. Management scholars have addressed the decision-making research from the process, effect and influence perspective. The path of process research involves the study of how decision should be made and how they are actually made. The early works of Eilon (1971) stated that the DMP comprised of two parts involving the search and execution of a solution, however achieving both requires a comprehensive loop of processes. Similarly, Simon (1979) stated that DMP involves three stages that included identifying the need for a decision, seeking out possible actions and choosing the best course of action while Harrison (1999) defined it as a continuous process involving the evaluation of alternative towards meeting an objective.

Nutt (1984) and Mintzberg, Raisinghani and Theoret (1976) presented frameworks for the DMP used for this research, it builds on the rational decision-making ideology. The DMP as defined in Mintzberg, Raisinghani and Theoret (1976) framework is made up of three phases, identification, development and selection. These phases are characterised by seven activities, which are decision recognition, diagnosis, search, design, screening, evaluation and choice. In Nutt (1984) framework, the

DMP is made up of five stages and three routines. The stages include; formulation, concept development, detailing, evaluation and implementation while the routines are search, synthesis and analysis. Both frameworks are procedural with clear stages and routine however Mintzberg, Raisinghani and Theoret (1976) acknowledged the fact that decisions on an interest are only considered after a measured threshold of need for decision has been attained. This is the case for decisions in the renewable energy space since decisions are triggered on the basis of some internal or external stimuli. Therefore the assumed rational decision making process for this research is that as suggested by Mintzberg, Raisinghani and Theoret (1976).

The above assumptions idealise the principle of rational decision-making, which leads one to believe that there is a best outcome for every decision-making process (DMP), taking a sequential and procedural approach. On the contrary, most DMP cases never have the above stated conditions as exemplified in garbage can model (Eisenhardt and Zbaracki 1992; Zahariadis 2016).

In reality the DMP is strongly affected by environmental factors and cognitive ability of the decision maker, investment in renewable energy solutions is one of such areas where perfect rationality fails to apply due to the uncertainty (Wüstenhagen and Menichetti 2012). Since rational decision-making assumes perfect information availability and information symmetry it becomes unsuitable considering the uncertain conditions that stage of development introduce. In addition, since most decision situations fail to meet the requirement for the rational approach, a more context-based approach is advised, one shaped by environmental and human cognitive factors as conceptualised in bounded rationality (Simon, Egidi and Marris 1992). This research focuses on the context and its influence on the nature of the process and assessment procedures.

Although the influence of the environment on decision and their processes has been acknowledged, the decision process itself is a collection of decisions that cumulatively lead to a final decision. Consequently, this shows that all decisions are ranked differently; final investment decisions plausibly are ranked higher than decision to carry out initial feasibility study. In the same light it can be argued that the approaches, processes and assessment procedures are likely to differ depending on the type of decision been made, stage of market development and nature of actor involved. This is relevant especially in the context considered in this research where decision makers from one markets may be involved in the project development in market distinctly different. It is also valuable from the policy standpoint to know the potential process requirements and decision-making indicators used for the definition of policy in the attempt to attract developers. Finally, having mentioned the distinction between classes of decisions, diversity of firms and market diversity, it is important to state that an overall consideration of the decision process is to be explored. However the assessment interest will be restricted to the diagnostic stage of the DMP as referred to by (Mintzberg, Raisinghani and Theoret 1978) which is the point in the process after the need for development signal has reached its threshold. This analysis of the decision making dimensions raise two key concerns, the first is associated with the appropriateness of the rational decision-making model challenged by the lack of information and uncertainty introduced by the nature of the operating environment (Elbana and Child 2007; Polasky 2011), secondly knowledge of the diversity introduced by the market and actor factors is a firm basis for the need to review viability assessment which is part of the decision-making process using a system-based approach.

3.5 Sustainability and Viability

The sustainability concept has successfully transformed from a global environmental call, which hinged on corporate driven mission for process and product improvement through environmental responsiveness into a more social and now economic one. It has also translated into defining and altering individual behavioural and organisational strategic attitude. Although there is a consensus on the need for achieving the above, the inherent cost and benefits has differentiated the approaches taken by governments, corporate bodies and individuals. Swart, Raskin and Robinson (2004) articulated their thought on the challenges with addressing sustainability; it was classified as a choice problem around potential pathways with external and internal factors influencing any chosen approach. The authors also emphasised the need to contextualize the potential sustainability challenge using scenario analysis, this could be as a result of the varying interacting conditions and prioritization required while deciding on potential solutions.

The sustainability challenge is addressed using knowledge production and norm creation as suggested by Rametsteiner et al (2011), in this case experts generate information from situations that require improvement while social actors institute new standards based on historical or current ideologies. The choice problem is tackled using information and processes that are in constant evolution thereby introducing uncertainty and risk. Miller (2013) found the emerging themes within sustainability to be universalistic and procedural sustainability. The universalistic or thin approach focuses on outcome without a clear consideration of the interactions that lead to the expected outcome, so it could be considered minimalist but not trivial. An example of its simplicity is seen in the need to achieve world peace which of interest to every nation, however the reality remains that it requires transnational trade-offs, which are complex to achieve across nations. A research specific example is delivering electricity for all, a global cause that has triggered the emergence of low carbon options. However, the context and interaction required for the adoption and implementation are in certain cases poorly considered as is noticed in failed leapfrog cases.

Procedural sustainability on the other hand represents a process of learning and adoption in the midst of changing human and non-human conditions to achieve sustainable outcomes. This notion present the sustainability argument as one, which is temporal, and continuous with clarity in operationalization, gained within the context of application. The procedural dimension also highlights the importance of contextualization as it allows for the micro-level analysis of solution such that interactions can be identified and understood.

The issue of context was further emphasised within the work of Miller (2013) where the need to consider sustainability using the coupled systems approach was identified. This approach tackles the problem of specificity, as problems and solutions can be compartmentalized within organizational and operational boundaries in other to promote clarity of interaction for effective information gathering and knowledge management. Similarly, Clark et al. (2010) highlighted the need to simplify the notion of sustainability by making it solution driven around specific problem orientations since these problem orientations affect the interactions within the system under consideration.

The sustainability concept is plagued with the criticism of its varying representation, as such raising concerns about its operationalization with different actors having opinions depending on their objectives (Swart, Raskin and Robinson 2004; Rametsteiner et al. 2011). This is not necessarily out of place since different systems face different problems and require different approaches for tackling them. Fikel (2006) and Miller (2013) suggested that the coupled system approach addresses this concern. It addresses sustainability from the system and interaction perspective, making the sustainability issue unique to systems as opposed to generalised representations. Hence the varying representations of sustainability have their inherent challenges and benefits. Consequently, sustainability in this research is themed around the ordering of interest in a system-oriented manner capturing contextual elements of change and transition.

Viability on the other hand is a concept which has found its way into the management and technological sciences from the life and environmental sciences where it has been primarily used to represent measures of function especially in the study of cells and tissues (Bewley and Black 2012;Mace et al, 2014) and a measure of limits and control within the environmental sciences. The consideration of viability in this research is entrenched in system theory and orientation theory which is a development and management principle that considers the interaction of entities on the basis of their functions within boundaries of operation (Bossel 1999;Mele, Pels and Polese 2010).

Essentially viability from this standpoint involves the understanding, identifying and prioritizing system entities on the basis of function within their system boundaries. In the ecological management field, viability is represented in the form of control when exploitation of any natural resource is considered (Cury et al. 2005; Eisenack et al. 2006) while in the area of interest renewables development it has been used as a measure of economic productivity under varying operational conditions while considering environmental impact (Dalton et al. 2009; Byrnes et al. 2016). Since businesses exist on the condition that they can meet a market need in a sustainable manner, it will be appropriate to say that viability and sustainability represent the overall interest of the firm.

3.6 Viability Framework (A System-Based Approach)

Viability assessment approaches and the methodology utilized in literature as discussed in Chapter 2 were considered to be lacking in terms of its ability to effectively capture firm's interest and market diversity. Consequently, the assessment dimension of viability as applied in decision-making is explored in this section.

The viability assessment scenario developed here studies development of RE solutions as a transnational activity; therefore viability assessment must capture the varying market representations. Secondly the notion of variety in actors also raises the issue of varying interest, which will also affect the viability representation. Here viability is defined as the state of minimum positive existence. The consideration of viability builds on the theory of the firm underscoring the firm interest, as the ability to secure profits to ensure longevity while securing non-profit based values.

Having identified the possibility of objectives changing as firms and markets change, it is also plausible to posit that the framework for assessing viability should be adapted to capture the system interactions resulting from these variations. A case worthy of consideration is that of an entrepreneur developer and a vertically integrated utility company participating in the same electricity market. Although they operate in the same market space, both actors are exposed to varying resources and constraints therefore their perspective of viability will be assumed to be slightly different. Secondly if viability was a measure of the potential to exist and thrive in the operating environment, it is also plausible to see that decision-making factors may be slightly different for both actors since their strategic objectives are fundamentally different. Consequently, it is necessary to reconsider the overall viability assessment model using a system-based approach. The system-based approach addresses problems with the view of taking the microcosmic view of system component and their interactions. This involves the identification of system components with the intention to understand their interactions within their system boundary. The system boundary in the renewable development case represents the electricity market, which is a social system made up of stakeholders with varying interests.

In this research Bossels viability assessment framework (Bossel 1999) and the Viable System Model by Beer (Beer 1984) were considered. Both frameworks use the system approach where the unit of the analysis is system elements and their interactions. Bossels looked at viability as a measure of overall system performance with emphasis on system components and their function on a component-to-component basis and also on a component to system basis. In this perspective a system is only viable if its components meet their basic function and go beyond to meet the overall system function, according to Bossels this is the only time a system can effectively survive and thrive. Similarly, the Beers model also addressed viability from the standpoint of function but focused on optimization. However, in the context of change and uncertainty as characterised by the market state for renewable development that approach is practically unsuitable.

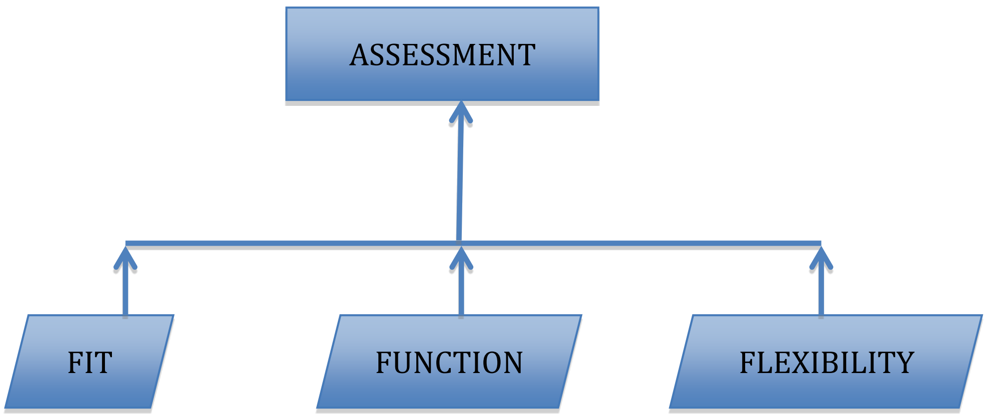
The Bossels framework looks at systems as active entities that proactively and reactively adjust to environmental pressures or constraints to be viable. Six standardized constraints dimensions have been associated to the measure of a system's viability as suggested by Bossels; they are normal environmental state, resource scarcity, variety, variability, change and flexibility to other systems. Fundamentally these different dimensions introduce limits to the systems under investigation as such challenging its viability and existence. Therefore, addressing these dimensions ensures the overall viability of the system.

The normal environmental state as suggested by Bossels represents basic requirements and constraint needed in a system for survival. An instance of an infant requiring a family unit and the fish requiring the aquatic ecosystem can be assumed. The provision of this ensures that existence is guaranteed. The resource scarcity state raises the awareness of the constraint of resource availability and the need for effectiveness. The last three constraints, variety, variability and change point to a systems ability to make adjustment and adapt. Therefore measures of viability have to provide information indicating the satisfaction of these constraints. Translating this to the electricity market within which development of renewables is implemented, a few analogies can be drawn.

The electricity market is a system, in this case a social system within which firms must conduct business. The firm can be represented as one component of the social system, however the ability for the firm to be viable is entrenched in its ability to function and interact with other components within the system. Here the social system is conceptualised into three major units, Developer, Stakeholders and the Environment with interactions that should establish viability. These interactions are fundamental in establishing measures of viability. Bossel (1999) recommended that a clear definition of these interactions be established before the development of the measures of viability. Since this research seeks to address viability from the firm's perspective, the interactions that must promote viability exist between the developer and other major units on these five (5) levels. The Developer interacts with the policy maker, shareholder, consumer, supplier and the environment.

The establishment of viability as adapted from the Bossels framework is represented by three themes (as compared to six themes in the original framework). These adjustments were made to suite the system of interest.

FIGURE 3.2 Viability Framework



Source: Developed by the author

The figure above shows that actor's interest and environmental influence are expressed in strategy and can influence the method of assessment as shown in the adapted framework represented by Fit, Function and Flexibility. Fit is adapted from the existence theme to represent the ability of a firm to match its development interest to the need of all stakeholders. The market stage of development is represented as a source of environmental influence that shapes the interest of developers; as such development decision criteria are likely to be different across the different developers. The second theme displayed in the figure is that of function in line with the effectiveness theme, this reflects the ability of the firm to deliver its core value, which is power generation. The final theme flexibility is adapted from the last three theme of security, freedom of action and adaptability to reflect the ability of a firm to adapt and learn in the market environment.

So applying this to the RE development interest, from the theory of the firm, it has been established that firms have an overarching objectives that represent their interest to exist and thrive in there market of interest. For instance a developer group has a duty to the stakeholders, regulators and the environment. The developer has to first identify that the development of interest can be funded, meets a need while matching organisational goal. Essentially the project must fit the developer's interest in that sense. For the shareholder, the developer must ensure that return on investment can be secured. Also, to the consumer, the power produced has to be affordable and finally the developer has to comply with regulatory constraints. So, using the adapted framework, the interacting elements have been identified and the ability to satisfy them guarantees existence, which in this research is represented as viability.

3.7 Summary

The idea that firms have a strategic objective of profit making was addressed stating its origins and its evolution. Looking at the various theories that address the firm, profit-maximization was found to be one in many interests that firms seek to address. Firms seek to be politically relevant, legitimate and compliant, resourceful and able to develop capability to establish advantage. All these interests fundamentally point back to the profit making interest of the firm, which is achieved through the lowering of transaction cost. The adoption of renewables defies this notion since conventional energy utilised in energy generation offers a lower transaction cost to intending developers. Hence the developer is faced with the dilemma of choice, both experienced developers in mature markets and new developers in less mature markets share this challenge.

The problem is escalated in the cases where experienced developers seek to develop projects in less mature markets and when policy makers in less developed market need to drive diffusion. This presents a complex problem of choice intensified by potential influence of market of intended development and the firm of interest. In the case of an experienced developer seeking to internationalise, the choice to develop a project in a less mature market will require a strategic view that captures the environmental context. The strategic position for such a project will be different as compared to a development project in a mature market. Therefore, the decision to develop a project will require the consideration of the context in terms of market and firm's interest.

Furthermore, with the decision process also likely to be influence by these context factors, the argument for the adoption of the rational decision-making approach is challenged. This is on the premise that the features that suite a rational decision-making process are less likely to be met if environmental influences are to be accounted for.

Although the rational decision-making approach is been challenged, there also was the bounded rationality approach, which accounts for the cognitive and environmental influences on decision. The point was made that decisions were unequal in magnitude and relevance. With this unequal weighting they will require different processes and assessment approaches. However, the assessment interest of this research focused on the diagnostic stage of the decision-making process, which is considered to be the stage where the firm decides if a project, is worth incorporating into the firm's portfolio. This is critical in the life of a prospective project both for the developer and a potential benefiting nation.

This therefore raised the question of assessment; if the motives for strategic choice differ across the life cycle of a firm and market then the measures for assessment will certainly differ. Consequently, the framework for assessing viability was adapted from the viability assessment by Bossels. The framework advocates that viability as a system property fundamentally involves fit, function and flexibility. Therefore, systems can only be viable if they meet these three dimensions. These are applied in this research as a basis for the decision-making. The next chapter looks at the methods and strategy to addressing the questions built around the ideas formalized in this chapter

CHAPTER 4 METHODOLOGY

4.1 Introduction

The research methodology encapsulates the ideas, path and justification for the approach used in reaching research outcomes. This section is a product of synthesis and critical review of approaches involved in answering the set out research questions developed as presented in Section 1.3.

The nature of any investigation whether it is exploratory, explanatory, descriptive or even experimental is known to fundamentally influence the path through which the research outcomes are achieved (Yin 2013). Hence the nature of the investigation shapes the research methodology. Creswell (2014) itemized three areas to be covered in other to fully explain how research outcomes are reached; they are research philosophy, design and methods. This comprehensive representation captures the interacting aspects of research from literature analysis, theory development to choice of data variables and how they are analysed. Essentially it describes the foundations for knowledge inquiry, logic behind the inquiry, tools used to collect information, method used to make sense of the collected information and reporting style. This research branches into the area of decision-making (DM) process and its assessment.

In the research of strategic decision-making (SDM) and strategic choice (SC), the research methodologies implemented have been varying depending on the nature of the anticipated research outcome. The research interests in SDM and SC has been broadly divided into understanding process, evaluating outcome and their facilitating context (Elbanna and Child 2007). Consequently research interest has transitioned from simply explaining the fundamental normative DM processes to mapping mediating context with outcomes. Outcomes within the SDM research have been expressed either with respect to performance or effectiveness. The notion captured within the established theoretical framework in Chapter 3 suggests that there was a likely link between stages of market development as a context and DM process structure as well as its viability assessment methodology.

Mador (2000) stated that understanding DM processes requires a holistic approach, due to potential variations in interests a singular research endeavour can present. This corroborates the earlier position where intended outcomes could be exploratory, explanatory or simply descriptive. The questions and propositions developed in the earlier chapters tend to address a more exploratory position as such the focus is not matching processes to performance or effectiveness but matching processes to standardization while linking stage of development to assessment methods. Since this research fundamentally looks at developing a viability assessment measure for decision support, it was important to consider the process as the premise on which measures will be applied. As such DMP forms the lens for developing potential measures that reflect the interest of stakeholders.

This chapter reviews in details the different approaches employed by researchers in addressing strategic choice and decision-making research questions. Sections 4.2 and 4.3 present an overview of research philosophy and approach. The research design adopted is presented in Section 4.4, data collection method is presented in Section 4.5, operationalizing the viability measure is presented in Section 4.6 and pilot and data collection is presented in Section 4.7.

This forms the basis for considering different philosophies and research approaches which have been applied under different research circumstances with the aim of matching the ideal with the research questions posed.

4.2 Research Philosophies

Generation of new knowledge revolves around the existence of some baseline knowledge or paradigm, this baseline sets the direction and forms the lens through which research is viewed. The philosophical approach is the basis for the development and understanding of knowledge within research whether it is abstract or factual (Saunders 2011). Research philosophies offer a general framework upon which resolving research ideas are grounded; among them include Positivist, Constructivist and the Pragmatic frameworks, which could be applied to this research.

4.2.1 Positivist

This background of knowledge enquiry is credited to Auguste Comte who at the time was not impressed by the techniques used for studying social concepts since it relied more on intuition and interpersonal opinions. The argument was one that emphasised the lack of rigor in the process of research since it could not go through scientific tests and analysis. In essence the positivist position advocates objectivity, measurability and context independence (Partington 2000). The dimensions emerging from the Chapter 2 and 3 have been associated with research ideas that lend to the positivist way of thinking, particularly when the effectiveness of diffusion and decision-making processes are to be measured.

In addition to the promotion of measurement and evaluation by the positivist school of thought, there is an assumed perception that context should not play any role in empirical investigations. However in social sciences the place of context is very crucial especially in empirical research. The contextual aspect of DM research has seen the growth in the use of empirically based research methods to analyses the effect of contextual factors of decision making outcomes and extent of rationality. Elbanna and Child (2007) used regression analysis after conducting an extensive case study of SDM for companies in Egypt as a means to develop success factors and operationalize them. Similarly the research by Dean and Sharfman (1996) considered 52 decisions across 24 companies using multiple regression analysis it was found that SDM process impacts on the effectiveness of decisions.

The positivist point of view seeks to establish causality on the basis of cause and effect (Hudson and Ozanne 1988) with the notion that there exist realities for which research inquiry simply confirms or fails to confirm. This position applies to both experimental and non-experimental studies with biases handled using controls and case selection strategies. Within the context of SDM, the examples used by Dean and Sharfman (1996) and Elbanna and Child (2007) highlights the existence of factors that affect the process of decision-making with the attempt to confirm the magnitude of their effect.

Although the positivist approach seems to have diffused from experimental into non-experimental research there is the concern of controlling bias, as with social science research the role of external influences is amplified when compared to the scientific or laboratory based activities with known and established controls. On the contrary Partington (2000) suggests that the context is one that is uncovered in the course of the research as opposed to one that shapes the research.

Fundamentally, this approach to research acknowledges the idea of the existence of knowledge or a theory and seeks to prove or modify that body of knowledge, which leads to the uncovering of contextual connections that explain the discoveries. In relation to the current research the positivist perspective has been used to verify the theory of the firm, however the behavioural dimension of the firm, which is exploring the decision-making process, is not necessarily measurable in the context of positivism as such making it unsuitable.

4.2.2 Constructivist

The attempt by researchers to understand concepts, phenomena and further develop explanations for relationships requires a different approach. As the positivists seek to confirm the existence of reality through scientific and empirical approaches, the constructivists seek to question, challenge and in certain cases create reality. Schwandt (1994) asserts that understanding concepts within the world of lived experience; researchers need to adopt the constructive and interpretive philosophy. This is because the reality of the world within which life experiences are created is subject to conditions of time and space. Since individuals seek to reach a better understanding of their world, inquiry will be based on their shared experiences and the ability of the researcher to develop themes that capture the meaning of phenomenon of interest (Creswell 2014) which are developed through time.

This philosophy is typically associated with qualitative research partly due to the subjective nature of inquiry and type of analysis implemented. The notion of subjectivity is discussed by Schwandt (1994), which is represented in the form of perspective, making the subject of inquiry open to multiplicity of representations and interpretation. In terms of analysis, Garcia and Quek (1997) ascribed the subjective nature to the lack of applicability to statistical analysis as opposed to the positivist position where the basis of accepting an understanding of reality is built around the empirical analysis. Crotty (1998) argued that interpretations about the world we engage in is continuous as it is dependent on the extent of engagement hence researchers apply open ended questions so participants can share their views as they develop. In addition, experience and background shape the way to look and make sense of the world. This philosophy allows for the development and interpretation of reality using the lens of the participant in the case where individuals or phenomenon that affects individuals are studied, as is the case for structure of decision-making process. The distinction between studying a process and its effects although not explicitly stated in this work forms the link between the positivist and constructivist perspectives in research on decision-making. The positivist seeks to understand and validate the effectiveness of a decision on the basis of performance, the constructivists seek to develop an in-depth understanding of the how and what makes a process. Linking the aforementioned, to the current research makes this approach suitable for adoption since the research focuses on getting insights about decision-making process as applied by firms with varying interests and strategic objectives.

4.3 Research Approach

The clarity in research is obtained with definition of a research approach; its primary purpose is to outline the process leading to expected outcome of a research activity. The process involved in meeting research outcomes captures the logic, motive and justification behind choices used in research. (Creswell 2014) identified qualitative, quantitative and mixed approaches. However, these approaches are not polar opposites. Similarly (Kothari 2004) categorized approaches into quantitative and qualitative on the basis of level of involvement and control the researcher has over the inquiry. Creswell categorization focused on the nature of inquiry where inquiry is about sense making or understanding individuals, groups, systems or phenomenon. The qualitative approach is preferred for inquiries that are considered inductive in nature. On the contrary when the inquiry is focused on testing cause and effect of variables emanating from theories the quantitative approach is suitable, which is classified as a deductive approach. As has been stated earlier the distinction between these approaches are not clear cut and that is highlighted in mixed approach (pragmatism) since it features the development of understanding as well as testing for cause and effect. (Collis and Hussey 2009) approach research from the inductive and deductive perspective. They consider the logic of research to be founded on how and what is done to reach the research outcomes. These different representations make it important for researchers to clearly understand research questions and their anticipated outcomes in order to develop or adapt a path, which leads from observation to theory or from theory to confirmation of cause and effect. Consequently to achieve the fit for a suitable research approach, literatures on SDM and assessment of renewable investment have been reviewed. This is necessary in other to identify potential complication and solution before deciding on potential research methods.

Since research on decision-making focuses on process and outcome (Elbanna and Child 2007) advocate that understanding processes require the use of inductive methods while evaluating outcomes involved the use of deductive methods. Considering the plurality in the potential paths for this research, it is necessary that both approaches be reviewed.

4.3.1 Deductive Approach

Hyde (2000) stated that deductive approach starts out with generalizations and moves towards specificity. Consequently the question of how the move toward specificity is achieved is raised. In addition, there exists a notion that deductive approach is associated to quantitative research because of the empirical nature of analysis.

Research in SDM makes an argument for using the deductive approach, (Dean and Sharfman 1996) used the deductive approach to establish a link between decision effectiveness and potential factors that influence effectiveness, which include rationality and environmental dynamism. These varying theoretical positions were tested using purely quantitative methods. It should be noted that this was achievable because of the size of sample and more importantly the nature of the research question. Similarly (Amason 1996) used the deductive approach in the research that considered conflict within top management teams engaged in strategic decision making. It has been identified that researchers tend to prefer the deductive approach but fundamentally its relevance is tied to the nature of the inquiry and type of research outcomes expected.

Other researchers criticize this approach since it requires large sample size, in addition it involves a wide range of variables that are purely subjectively selected depending on the contextual assumptions of the researcher (Bryman and Bell 2007). This current research interest does not lend to the deductive approach since it explicitly does not seek to test cause and effect as such no hypothesis is tested.

4.3.2 Inductive Approach

While research serves the purpose of establishing reality through the generation of facts through experimental, scientific or empirical analysis, another aim of research seeks to generate and expound on existing theories using real life data. These theories are developed from the understanding of concepts and their interactions taking the form of relationships and effects. This approach to research involves the emersion of the researcher into the phenomenon of interest through observation and analytic thinking. The inductive approach may be misconstrued to represent the development of theory but it is the process, which involves self-reflection, understanding and development, as stated by Bryman and Bell (2007).

Another interesting dimension to inductive approach is its relationship with qualitative analysis; the work by Thomas (2006) addressed the primary purpose of this approach. It allows for the emergence of significant themes from raw data and most importantly it involves a procedural and structured approach. One inherent benefit of this approach is the value in use when considering historical and case based research interest where researchers have limited or no control over the subjects but simply engage in the sense-making rigor within available data.

Consequently the permissive involvement of the researcher has raised a sense of concern in the level of reliability obtained from inquires of this nature. Saunders (2011) highlighted the limitation of this approach that emanates from potential researcher bias, lack of pattern emergence within the data, time and failure in generalizability. However this is addressed by the researchers ability to be reflexive, which is achieved by the admittance of potential bias caused by researcher's opinions and foundational knowledge.

In addition these limitations can be mitigated where research objectives extends existing theoretical arguments, since the researcher has extensive knowledge in the subject area and the boundaries for generalization are clearly defined as in the case of unique research subject areas that can be generalized using few case examples. This current research adopts the inductive research approach since it considers making sense of the context stage of development. The interest is in line with process tracing and observing variations in process with changing market dynamics.

4.4 Research Design

The approach taken in this research focuses on finding out the risks associated with development from the developers perspective while exploring what actually happens in a decision making process. Although the decision-making process has been studied extensively, there has been a lack of research within renewable development. On the back drop that RE projects are considered to be time consuming and riddled with uncertainty especially in the context of different markets of operation. This research involves the real life data as shared by participants in the process; therefore it is inductive based. The inductive method utilizes findings from the data and empirical evidence associated to the decisions and the representing firm, which should be instrumental in explaining the influence of the environment on the process and viability assessment. This is in contrast with the deductive approach where data is found to validate and explain theory, “inductive researchers hope to find theory that explains their data” (Goetz and LeCompte, 1984, p.4).

Although the core approach adopted is inductive, this research starts with a deductive search for decision factors generated from the consideration of barriers and drivers of RE development. This is to be used in the attempt at explaining the viability assessment approach adopted by the firms, which is part of the decision-making process. This collection of factors is built from literature review of barriers and drivers and decision-making parameters across different country classes. In addition the concepts that emanate from the analysis of the decision-making process form the framework for the empirical investigation as well as theory development. The empirical results and findings will be analysed in line with the theoretical framework already established.

The research design therefore adopts both deductive and inductive approaches. The first step involves the identification of main factors (concepts and decision factors) that are the most pressing features of the decision-making process and considered in the assessment of viability. The second step is to conduct an empirical study (based on the identified factors) of how firms make their decisions as it concerns projects. By implementing an empirical investigation, an in-depth understanding of the decision-making process applied by a firm in a particular market stage of development can be obtained. This has the potential of confirming or disproving the existence of market stage effects on the decision process; also the relevance of the normative decision-making approach is also tested. New factors that shape these decision-making approaches might be discovered and will appear in the decision model.

In this study, two stages of analysis the within case analysis and cross case analysis is adopted. For the within-case, each case is first presented as a comprehensive case in and of itself. The second stage, attempts to see processes similarities and differences across cases with the intention to qualify market effects. This approach is quite useful since simply summarising the cases superficially across the concepts or decision factors by itself tells us little. The intention is to explore carefully the complex configuration and interactions with each case and understand the role of local environmental condition and firm characteristic on the process.

4.5 Data Collection Methods

With this research capturing the firms that are established and growing, the existing theories built around data obtained from established firms and markets is likely to be unsuitable for explaining process behaviour for growing markets. However, existing theories may also be useful in explaining the behaviour of the established and growing firms. This research is exploratory and explanatory in nature. Therefore, theory building and theory testing methods to research are appropriate.

4.5.1 Case Study as a research strategy

The term 'case' comes from the Latin word casus meaning 'occurrence'. The use of case study points to units of analysis or study, a case can be a part of an integrated unit or a single entity worth studying (Stake 1995). Wolcott (1992, p. 36) highlighted that a case study can be "an end-product in a field oriented research", which is a holistic description rather than a strategy or method of research. The above suggestions show that case studies can contribute to a general and specific understanding of the nature of cases. In summary, a qualitative case study can be defined in terms of the process of actually carrying out the investigation, the unit of analysis or the end product. Merriam (1998, p.34) defined a case study as "an intensive, holistic description and analysis of a single phenomenon or social unit".

Considering Yin (2013) classification of research question, this research presents what style question within the context of understanding how rationality and stage of development interact and impact on decision making for a renewable energy solution. The evaluation of choice and process offers several options for insights into capturing what works for utilities in their prevailing conditions of operation, as such the case study approach suits this research inquiry. This approach also is considered when the researcher has little control over the events of interest and when the focus is on a contemporary phenomenon.

In the context of my research, the case study method is consistent with the research philosophy and potential research outcome since the study seeks to investigate the process used by firms in different markets as they make decisions to develop renewable projects. A case study design is going to be employed to gain an in-depth sense of the decision-making process applied by the firms. This research focuses on the process rather than its effect or outcomes. The research is complex, since it captures varying contexts within which decisions is made. Therefore the arguments supporting the need to study decision within their context are plausible (Aharoni, 1966).

4.5.2 Formal Survey (Viability Matrix) as a part of the research strategy

As a part of the case studies, a formal survey was conducted after qualitative open-ended interviews with the decision-makers. It involved the use of a questionnaire matrix capturing the potential decision factors and the viability themes. Since the interest of this research was to establish a link between risk and sustainability, to understand process and observe the patterns within a cross section of decision over time, interviews was adopted since they offer the opportunity to obtain in-depth information on the subject. Interviewing was used in the study in order to gain insights into past events involving only a few selective decision-makers. Consequently, interviewing was the only way to get data, in this type of research the crucial factor is getting the right decision-makers as they possess the information required for understanding the phenomenon of interest.

Six top decision-makers participated in the qualitative interviews. The interviews was semi-structured captured the elements as highlighted from the normative approach of decision-making. In general, the interviews were planned for an hour; in one particular case it was not sufficient since the decision-maker had other more pressing engagements and it was rescheduled.

After the interviews, the managers were asked to fill in the viability matrix as it applies to their organisations strategic interest. Since the interview focused on the process, the questionnaire focused on the decision factors, which is more extensive especially if interviews were not elaborate.

Four managers filled in the questionnaire with two from the same company stating that the questionnaire was to subjective, choosing either to do it right after the interview, or to find time and return to me by email.

The questionnaire took the form of a two-part matrix; one was the viability assessment matrix while the other was a decision factor prioritization ranking as it applies for a firm in its current market of operation. It is based on the concept that viability assessment involves the matching of decision factors to viability themes as highlighted in the theoretical framework. Also the decision-factor prioritization part gave weight to the relevance of decision-making indicators from the firm's perspective. This numerical dimension represents the value in terms of significance a particular decision-making factor has with respect to its process. There was no quantitative measurement or ranking for decision factors in terms of influence on the decision-making process but there was a place for comparative relevance across firms.

The purpose of the interviews and questionnaire was to establish the existence or the absence of a process, test the relevance of decision-factors and generate some factor prioritization association across firms.

By conducting these personal interviews, it was possible to overcome any concerns about motives for obtaining information about the development decision-making process.

4.5.3 Other data collection methods

In the course of preparing for the interviews and while it was on-going, it was logical to search and collect as much information for other sources such as documents, company reports which gave me insights that directed lines of questions.

The method chosen for data collection was the case study approach, which involved personal and telephone interviews, administration of questionnaires, as well as documentary analysis.

4.6 Operationalizing Variables for the Viability Measure

Having established in chapter two the relevance of decision factors and their linked emergence from the discussed barriers and drivers that are considered as critical in the development of renewables. It was logical to associate them to development and investment decisions, since most engagements in the sector rely and consider these factors. These factors are essential in the decisions surrounding the investment and development of a renewable energy project and critical in the establishment of viability. It was important to establish the decision factors or indicators as will be used for the viability assessment aspect of this research. After an extensive search of literature in the areas of development and investment in decision-making for renewables and also life-cycle assessment, sustainability and multi-criteria research analysis research, the table of indicators below was generated. The indicators represent a collection of potential decision-making factors that could be useful to all classes of developers across the different stages of development. With the interest been establishing the association between indicators and viability interest of the firm, which should link back to the strategic position of the firm, the indicator pool although not exhaustive forms a good representation of indicators as used in by other researchers.

Although the approach of extensive search for indicators is important so as to cover all potential decision factors but there also the need to be systematic and specific. For that reason three papers (Lee et al. 2009; Guerrero-Liquet et al. (2018); Gulcin et al. 2018) were chosen, two addressed the decision making for wind and photovoltaic projects respectively while the third one was a more energy centric indicator selection pool. These indicators meet the selection criteria of been systematic, independent, consistent, measurable and comparable as suggested by Wang et al. (2009). The Table 4.1 below represents a summary of the indicators or decision factors as gathered from both papers and their justifications.

TABLE 4.1 Indicators and Decision Factors

Indicators	**Source**	**Justification**
Affordability of Electricity (Levilised cost of electricity)	Gulcin et al. 2018 Guerrero-Liquet et al. (2018);	Price of electricity generation unit has to be considered, it has to deliver profit while been affordable to the consumers
Investment Cost	Lee et al. 2009 Gulcin et al. 2018	This cost is a representation of the total expenditure incurred in establishing the project
Operation and Maintenance Cost	Lee et al. 2009, Gulcin et al. 2018	This captures the cost of running the plant including salaries, cost of parts and scheduled maintenance

TABLE 4.1 Indicators and Decision Factors (CONT.)

Indicators	Source	Justification
Net Present Value & Payback	Gulcin et al. 2018, Guerrero-Liquet et al. (2018);	It is the discounted net present value of cash in and outflow and the time it takes to cover the cost of initial investment
Market Development	Gulcin et al. 2018, Guerrero-Liquet et al. (2018);	It is the representation of the market stage of development in terms of competitiveness and clarity in regulatory processes
Climate Change	Gulcin et al. 2018 Guerrero-Liquet et al. (2018);	This is linked to green house gas emission and the potential of the solution to correct emission
Land Use and Noise	Gulcin et al. 2018 Guerrero-Liquet et al. (2018);	This is key parameter as there is the issue of conflict since land used could pose a risk to biodiversity and also interfere with agricultural activities
NO_x and SO_2	Gulcin et al. 2018	Green house gas emission is a concern as such a key parameter in the definition choice
Wind Availability	Lee et al. 2009	Resource availability must be considered since technologies depend on it for generation.

TABLE 4.1 Indicators and Decision Factors (CONT.)

Indicators	Source	Justification
Waste Odour and Particulates	Gulcin et al. 2018	A measure of waste and particulate matter produced.
Ecological Impact	Gulcin et al. 2018 Guerrero-Liquet et al. (2018);	It is a measure of change or loss in the natural habitat caused by the project
Poverty reduction and prosperity	Gulcin et al. 2018, Guerrero-Liquet et al. (2018);	This is a factor associated to the allied benefits a power project brings into a community.
Compliance with national agenda	Gulcin et al. 2018, Guerrero-Liquet et al. (2018);	It is a reflection of national policies that drive development that take the form of national targets
Social and political acceptability	Gulcin et al. 2018, Guerrero-Liquet et al. (2018);	The consent of the host community is critical since public objection could lead to delays or even abandonment.
Job Creation and Quality	Gulcin et al. 2018, Guerrero-Liquet et al. (2018);	The ability of an energy project to generate jobs to its host community is an important factor to be considered
Community Benefits	Gulcin et al. 2018	The positive impact on local communities is also critical when deciding an energy project

TABLE 4.1 Indicators and Decision Factors (CONT.)

Indicators	**Source**	**Justification**
Maturity and reliability	Lee et al. 2009	The acceptability of technology is a key indicator since that reflects its efficacy and ability to meet functional need
Modernity and efficiency	Gulcin et al. 2018	This makes reference to generation capacity of the chosen technology solution
Technical feasibility and Safety	Gulcin et al. 2018	This is a measure of the systems ability to perform as intended. It is very critical
Local Know-how and maintainability	Gulcin et al. 2018	This captures the expert man power available in the region to install, operate and maintain the equipment
Implementation speed	Gulcin et al. 2018	The time spent on the execution of a project is also a critical factor.
External Supply risk	Guerrero-Liquet et al. (2018), Lee et al. 2009	A measure that reflects the ability of a solution to serve as a hedge.
Policy support	Guerrero-Liquet et al. (2018), Lee et al. 2009	This factor is a representation of the existence of national policies supporting development

TABLE 4.1 Indicators and Decision Factors (CONT.)

Indicators	**Source**	**Justification**
Financial schemes / Access to Finance	Guerrero-Liquet et al. (2018), Lee et al. 2009	This measures the readiness and attractiveness of a market to facilitate projects
Wind turbine	Lee et al. (2009)	This reflect technology type and reliability
Grid Connection	Gulcin et al. 2018, Lee et al. (2009)	The existence of a distribution and grid system is considered critical.
Foundation	Lee et al. (2009)	Captures construction cost
Advanced technologies	Lee et al. (2009)	

Source: (Gulcin et al. 2018, p. 294; Guerrero-Liquet et al. 2018, p. 10; Lee et al. 2009, p.122)

4.6.1 Fit

This domain is reflective of the structure and form through which utilities engage in business. Utilities deliver electricity by the use of technology hence their operations form a key part of their value creation process. The emphasis in literature focuses on feasibility, sustainability and viability of renewable energy investment from the technology and operations perspective. This research extends this interest to the source that drives the choice that is the organization. Therefore the fit domain will be covering the organizational and operational fit.

4.6.1.1 Organizational Fit

Organizational fit in this research will be operationalized from the point of view of strategy. Since strategy seeks to deliver on business interest it has to cover the financial perspective, customer perspective, internal business perspective and regulatory concerns while considering the learning and growth (Okumus 2003). The resource-oriented point of view considers the firm core competencies to represent another source of advantage, its human resource form a significant part of this. In other to achieve clarity and sufficient segregation, this research limits the interest of the organizational fit to consider primary objectives In Atkinson, Waterhouse and Wells (1997) work on performance measurement, different levels and objectives of interest were developed, this approach is adopted in this section. Essentially meeting the direct interest of the stakeholder makes up the primary objective of the utility, which comes in the form of stakeholder contracts. This is achieved by keeping the utility in business and measures for this from literature include and are not limited to measures that deliver market attractiveness and return on investment.

Investing in renewables, like any other investment that relies on local resources both for patronage and product creation requires that availability as a primary objective is met. Nigim, Munier and Green (2004) considered resource availability as a core objective for viability of renewables in a community. It is also known that in the analysis of potential energy generation from renewable sources considerable attention is given to location specific criteria, which eventually strengthens the need to consider resource availability factor (Akorede et al. 2013; Ribeiro, Arouca and Coelho 2016).

Certain utility companies may be more prone to invest in places they consider more investment friendly in terms of policies and investment incentives. Hence viability should meet the primary objective of availability by securing resource location, policy, and market attractiveness and return on investment.

4.6.1.2 Operational Fit

As has been stated earlier, the emphasis on the operations has shaped a significant part of the body of literature on viability. The argument here is one that stems from the innovation perspective; innovative solutions are primarily targeting some form of improvement to technology that delivers competitive advantage in the form of efficiency or cost reduction. However taking into consideration the argument of Atkinson, Waterhouse and Wells (1997), the primary objective of technology providers is delivering on acceptability, affordability and accessibility fundamentally tied to its usefulness and usage intentions (Venkatesh and Davis 2000).

The usefulness and usage intention dimensions suggested could be operationalized across different technology solution depending on how they connect to the stakeholders need. Usefulness is contextualized in terms of how the solution meets the primary need, which is electricity generation, for this mature solution is more likely to be considered. Hence the primary objective of technology producers will be to deliver solution considered as mature enough to meet current user need. In addition to maturity, solutions must also complement existing solutions; hence the second measure will consider complementarity. Table 4.2 shows the representation of dimensions as captured under the Fit theme for the viability framework.

TABLE 4.2 Operationalizing Fit Viability Theme

FIT	OBJECTIVE	MEASURE
Organizational	Profit-making Availability	Access to Finance Market Attractiveness Resource Availability Policy Attractiveness Return On Investment
Operational	Usability and Usefulness	Maturity Complementarity

4.6.2 Function

A clear formation of organizational goals and objectives leads to the precise definition of processes and roles, which forms the second part of the adapted viability framework. Bossel (2003) developed the viability indicators along the themes of effectiveness, security and freedom of action, which are linked to handling the issues of resource scarcity, acknowledging variety and variability. In the context of resource management the above derivations apply but within the context of business, effectiveness and security are achieved by effective the use of internal and external resource. Here the resource-oriented view which looks at economic production to be dependent on resources and competence is adopted from the organization and operation standpoint with the secondary objective and goal been delivering effectiveness.

4.6.2.1 Organizational Function

Organizations deliver and create value through their processes implemented through the abilities by members of staff and use of technology after careful consideration and establishment of objectives. One of the arguments of this research is that significant attention is not given to the organization as an entity contributing to the adoption of renewable energy solution. Since both human and non-human capacity make up a significant part of a utilities competitive advantage, the emphasis is on human capacity since non-human capacity will be covered under the operational function dimension. Under this dimension the primary objective to be achieved is value creation. An effective, efficient and motivated workforce achieves value creation. In this light we consider competency to represent this source of value creation.

4.6.2.2 Operational Function

The technical and operational aspect of renewable development makes up a significant part of the body of research in clean energy production and rightly so since this delivers the product of interest which is electricity. The consideration for a solution goes beyond its ability to generate electricity since certain expectation within the life cycle of the solutions has to be met. The work of (Nigim, Munier and Green 2004) itemized them under impacts; these impacts cover environmental, social, technical and financial expectations. These indicators are mostly measurable; they are also associated to the sustainability dimension when that is considered explicitly. These dimensions are adopted in the Table 4.3 below.

TABLE 4.3 Operationalizing Function Viability Theme

FUNCTION	OBJECTIVE	MEASURE
Organizational	Value Creation	Competence Job Satisfaction
Operational	Generation	Technical Environmental Financial Social

4.6.3 Flexibility

4.6.3.1 Organisational Flexibility

Organizational flexibility as a dimension for viability represents growth and adaptability. It revolves around the learning, adaptive nature of the organization and how they manage environmental dynamism. Environmental dynamism represents the unpredictability of the operational environment; as such the ability to make sound decisions is tested under evolving environmental conditions. Priem, Rasheed and Kotulic (1995) reported the positive relationship between process rationality and highly dynamic environments however it's unknown if the process rationality incorporated any sort of new unplanned but documented processes or routine. Since the primary objective of the utility is to protect the interest of stakeholders an adaptive leadership style is necessary. In addition the ability of organizations to compete effectively is a product of a proactive leadership and creative work force hence the organizational culture has to promote research and partnership. Hence the dimension for flexibility is both for management and staff within the organisation is learning and collaboration.

4.6.3.2 Operational Flexibility

The utilities consider flexibility to represent grid capacity to handle adjustment to power demand and generation as well as integration that takes the form of the mix between different renewable sources (Huber, Dimkova and Hamacher 2014; Denholm and Hand 2011).

TABLE 4.4 Operationalizing the Flexibility Viability Theme

FLEXIBILITY	OBJECTIVE	MEASURE
Organizational	Adaptability	Learning Collaboration
Operational	Adaptability	Modularity and expansion, Integrability

Having identified these dimensions and indicators it is important to verify if the model as adapted in Chapter 3 above is representative of viability. Consequently a survey was carried out within the case study sample across utilities in United Kingdom (UK) and Nigeria using these dimensions and the measures as indicated. The UK was chosen because its renewable energy market has been recorded to move through different stages of development both with technology and market also because access to players in the market can be secured for interviews. The case of Nigeria was prompted because of its current drive to diversify its energy portfolio by the introduction of renewables, and the ability to secure participation by actors in the development sector.

4.7 Pilot and Data Collection Schedule

The electricity generation business is one characterized as capital intensive, under immense regulatory scrutiny and requires huge financial commitment. The research requires interactions with stakeholders in the electricity generating business with the scope of reference and unit of analysis been organizations that generate electricity in the United Kingdom and Nigeria. The industry was previously considered to be monopolistic in most parts of the world with few players and most prominently nationalized, but deregulation has opened the market up in theory. The huge financial commitment required still presents entry barrier into the industry. Hence the size of industry is skewed around the big utilities since they participate in all other aspects of the business.

In attempting to meet the research objectives there was need to test interview questions for representativeness, as well as the effectiveness of the viability matrix. Since the case study approach was adopted with the underlining method been open-ended interviews, the test involved getting questions that addressed the business interest of companies in the sample. This fundamentally led to discussions of development interest, DMP, risk and challenges the utilities considered during development and how they were quantified. In addition, questions were asked along the themes identified in literature for accessing the rationality of decision-making processes, similarly the market development context was explored.

Research on DMP has taken the empirical approach where factors influencing effectiveness of DMP are tested against the decision performance, this research drifts back into normative DMP space. As such, discussions addressed the motive for decision-making captured as stimuli (opportunity, threat or problem) in addition to search and development schemes, which reflected the extent of rationality, are adopted. The open-ended approach allowed the natural flow of conversation, which matched into the different dimensions for respondents. Two pilot cases involving a department that implemented a solar lighting solution and utility company were conducted. This provided an opportunity to test the question in line with meeting the stated objectives and in defining a clear data analysis strategy.

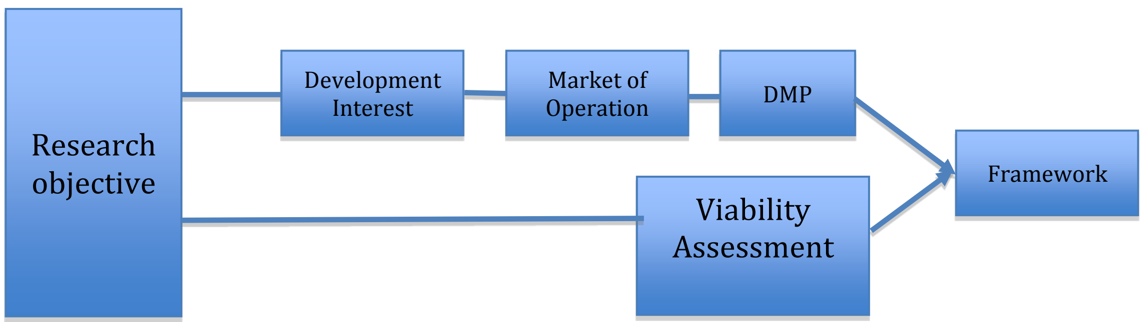
The research objective was considered timely as stated by one company respondent who admitted that the current market and conditions of operation has forced companies to reconsider their approach to assessment in the face of changing support regime and political tide particularly the exit of the UK from Europe.

The major highlights were the suggestion that the viability assessment indicators be grouped into the three main sustainability dimension (economic, social and technical), also there was a suggestion that brand value and tariff sustainability should be included to future strengthen the sustainability argument for the utilities. The schematic Figure 4.1 below indicates the analysis pathway adopted for this research.

4.7.1 Research Strategy and Analysis

The Figure 4.1 is a representation of the research objectives, context within which the research is situated and the phenomenon of interest (Decision-making process).

FIGURE 4.1 Analysis Pathway



From a methodological standpoint, the research can be addressed using either a positivist or constructivist perspective. The underlining research question developed has an underpinning assumption about the decision making process which is the phenomenon of interest. The assumption is that there is a standard process for decision making, which can be observed and measured. This process occurs within an social system, an operational environment and can be described using unique features that represent the environment as well as the process (Dean and Sharfman, 1996; Papadakis et al., 1998) with the associated features of comprehensiveness, participation, standardisation and motivation. From these factors, the codes for the process tracing are developed as shown in the Table 4.5 below.

TABLE 4.5 Codes and Factors for Process tracing

Codes	**Factors**
Process Indicators (Pro-Ind) – Process indicators	Comprehensiveness as a factor shows the level of complexity and detail applied to decision-making
Process Actors (Pro-Act) – Process Actor	Participation captures the people involvement
Rationality Protocol (Pro-Desc) – Process Description (Rat-Obj) – Rationality Objective	Standardization points to the use of procedures which have been embedded into organisational culture
Market Description and Stage of Development (Mkt-Desc) – Market Description (Mkt-Stg) – Market Stage of Development (Mkt-Int) – Market of interest (Mot) – Motivation	Environmental context reflects the social, institutional aspect of a system
Risk Hierarchy (Risk-Hier) – Risk	Risk perspective and concern by developers as it relates to the project of interest

Source: (Dean and Sharfman, 1996; p.116; Papadakis et al., 1998, p.1996)

The second assumption is in line with the notion that context within which a decision is made has the potential of influencing the process. So ontologically the phenomenon of interest is positioned within a context of its application and therefore shaped by the perception of the actors.

This representation therefore implies that knowledge formed relies on the context (operating environment) within which the phenomenon exists, is experienced or observed. In the epistemological sense, the constructivist perspective is suited for this research as it allows for the development of ideas, theories that explain a phenomenon from the generated data. This research assesses the process as adopted for decision-making, identifies and highlights deviations from the convention if any from data shared by the participants in the process.

The constructivism approach has been associated with different analytical approaches depending on the research endeavour. Since the case study approach is the chosen method, two stages of analysis are adopted. The within case and cross case analysis. For the within case, each case is first presented as a comprehensive case in itself. This level of analysis is targeted at getting and surveying in the data in a general sense.

The second stage, attempts to see processes similarities and differences across cases with the intention to qualify context effects. This approach is quite useful since simply summarising the cases superficially across the concepts or decision factors by itself tells us little. The intention is to explore carefully the complex configuration and interactions with each case and understand the role of local environmental condition and firm characteristic on the process.

Content analysis, discourse content analysis, thematic and process analysis are examples of constructivist analytical approaches. Content analysis and discourse content analysis are used to obtain exploratory outcomes when causality is not necessarily an interest. Content and thematic analyses have been used in the analysis of social acceptance as regarding adoption of renewables (Devin-Wright et al. 2017). Process tracing has been used in the exploration of decision-making processes and policy development (Svenson 1978; Kay and Baker 2015) however this has not been explored in renewable energy decision-making research. On the basis of the ontological and epistemological thinking associated with the research, process tracing and thematic analysis are the adopted analytical options to be utilized.

Process tracing is utilized here due to its dual function nature as both an exploratory and explanatory analysis approach, going beyond identifying themes, to establishing and associating cause to the phenomenon been studied. This research attempts to establish the existence and verify influence of external effects on decision-making process. Process tracing is utilized to explore and establish the existence of DMP as well as the elements of risk, which are considered in the process. In this case process tracing works as the tool through which the developed codes are identified and matched when exploring the case transcripts. It is not used in this research for in depth causative mapping. In the course of utilizing process tracing, the existence of coherence or deviation from the assumed decision making approach can be established. This addresses the third and first research questions. As part of the process analysis, codes were developed to characterise DMP, these codes were a combination of concepts from (Elbanna and Child 2007; Child et al, 2017). Philosophically this research builds on the constructivist idea that the phenomenon of interest is dependent of its context. As compared to factual realism as propounded by the positivist philosophy, the alternative approach looks at reality as a concept, which is experienced and this is the case for decision-making. There are existing theories explaining decision-making, however this attempt seeks to build on those theories. So analysing the interview data involved both theory driven and the identification of themes. The main school of thought for decision-making theory utilized here were the rational and bounded rationality dimensions, from these dimensions, the codes associated to the process emanation, description, actors involved and steps are generated as shown in Table 4.5. It was stated earlier that explaining causation is not the goal of this research, however the exploration of the process allows for the identification of potential factors that facilitated consistency or change in process. For this reason thematic analysis is adopted, this approach also builds on the constructivist philosophy as it allows for the development of representations from the respondents perspective while incorporating existing theory. This involves developing themes relating to the market context as captured in the transcript; these indicate the potential factors associated with process consistency or change. The thematic approach is also used in the analysis of the viability matrix in relation to firm and organisational interest and strategies.

The second level of analysis involved the use of the codes and themes in the case and across case analysis. This approach to analysis was necessary as it was important to establish the existence or the absence of the phenomenon of interest using real data generated from lived experience, which epitomizes the constructivism research philosophy.

Finally, for this research the process of identifying participants was a two (2) staged process, which involved identification and screening of potential firms and reaching out to the qualified participants. The consideration of potential respondents was segmented into the big utilities and the independent power producers as this represent the developers highlighted in Chapter 3. This was done in other to identify potential heterogeneity in DMP that may be linked to the type of firm and market stage of development, identified as a gap in the work of (Masini and Menichetti 2013).

4.8 Data Selection Stage 1

As part of the research there was need to engage with data, it was mentioned that there are two parts to the data selection process; in this section the first part of the process is discussed. Having generated research questions that raised issues of risk and sustainability, decision-making process description, assessment and the potential effect environmental effect. It was important to identify the data that will be suitable for reaching the established research outcomes.

The theory of the firm forms the foundation for the establishment of business processes, in this case decision-making. Although decision making in itself is the interest, the context within which it is applied has been considered to be important as it relates to its how it is made, type of firm involved in the process and its effect. Having considered literature extensively, there was the indication that renewable projects could be separated by the basis of their size and this links to their purpose. Small-sized projects are mostly pilot or test driven projects, which is purely outside the interest of firms seeking to make profit. Therefore this informed the consideration of segregating projects by size. Segmentation was introduced for potential respondents by classifying size of projects, which directly affects the type of support it attracts. This consideration was based on the notion that the different stages of development as identified in literature will shape the size of investment and type of support they attract which matches the initial motive of segmentation. Although segregation plays a role in focusing the research on projects considered to be purposely commercial, it should be noted that the UK participants have sequentially grown their projects from small-scale to the large-scale projects noticed in the market now. The dimension of project scale and size links to type and kind of support received which contributes to the sustainability and risk reduction. The United Kingdom renewable energy sector has witnessed series of policy transition from the Non Fossil Fuel Obligation to the current Contract of Difference, with the Renewable Obligation and Feed in Tariff been the most applied. In Nigeria, the major support available are the Feed in Tariff for investment sized between 5MW and 10MW for solar and wind respectively and Power Purchase Agreement for larger scaled projects. As such the size segmentation was classified into projects lower and equal to 5MW and the greater than 5MW of generating capacity.

The categorisation of support was utilized when the theoretical dimension of processes were developed in chapter 3 as a marker of market stage of development. With types of support associated to projects scale, it was important to capture support type and link back to scale of project. With the scale segmentation focusing on project scale, it was important to focus to narrow down into renewables of interest. From the literature and industry reports, solar (photovoltaic) and wind (onshore and offshore) have been the most diffused types of renewables. However in the Nigeria the interest is to develop photovoltaic and onshore wind with competency gaps in developing offshore wind while the UK had projects in photovoltaic, onshore and offshore wind. Hence the consensus was drawn to focus on the common renewables of interest since both countries, which are photovoltaic and onshore wind.

These classifications were further narrowed down to the two renewable energy solutions of interest, solar (Photovoltaic) and wind (onshore). The

Table 4.6 below captures the classification and categorization of the sample.

TABLE 4.6 Classifications and Categorization of Sample

Classification	Category 1	Category 2
Generators	Utilities	Independent Power Producers
Size of Project	5MW< Size > 5MW	5MW< Size > 5MW
Class of Project	Photovoltaic / Onshore wind	Photovoltaic / Onshore wind
Countries	United Kingdom	Nigeria

Since the target was to identify and understand DM process that could be generalized across participating agents in the industry with the potential constraint of low sample size due to restricted market entry, purposive sampling was adopted.

The renewable energy foundation (REF) and variable pitch (VP) database were used as the primary source of developer information for the United Kingdom. Unlike the United Kingdom, Nigeria lacks an extensive renewable database so latest information on power purchase agreement, from the bulk electricity trader and rural electrification agency was used. The information obtained was cross-referenced across the ECOWAS observatory for renewable energy and energy efficiency database (ECREEE).

Data obtained from REF was more structured therefore the search was sequenced for England and Scotland respectively across the selected technologies for large and small generators matching the size of projects of interest.

The selection sequence made across the different databases considered projects that fell into these categories as stated below

1. Two most recent accreditations
2. Two largest installations
3. Two oldest installation

These categorisations allow for capturing depth and breadth in involvement especially when considering processes, the intention to use two (2) per category is based on ease of screening. There were cases of reoccurrences when the largest installations and most recent accreditation search were conducted, since it was mainly distributed across the six (6) big utilities.

Table 4.7 shows the selection criteria for the UK cases across Solar and Wind projects. For this case the average of the total number of installations for the different utilities under investigation was taken and the top two companies in England and Scotland were identified respectively.

TABLE 4.7 Sample Selection Criteria

Selection Criteria		
Solution Type	Small Wind	Large Wind
Location	England / Scotland	England / Scotland
Criteria	Two (2) most recent accreditations, two (2) oldest installations and two (2) most recent installations	Top 2 based on average installed projects
Solution Type	Small PV	Large PV
Location	England / Scotland	England / Scotland
Criteria	Two (2) most recent accreditations, two (2) oldest installations and two (2) most recent installations	Two (2) most recent accreditations, two (2) oldest installations and two (2) most recent installations.

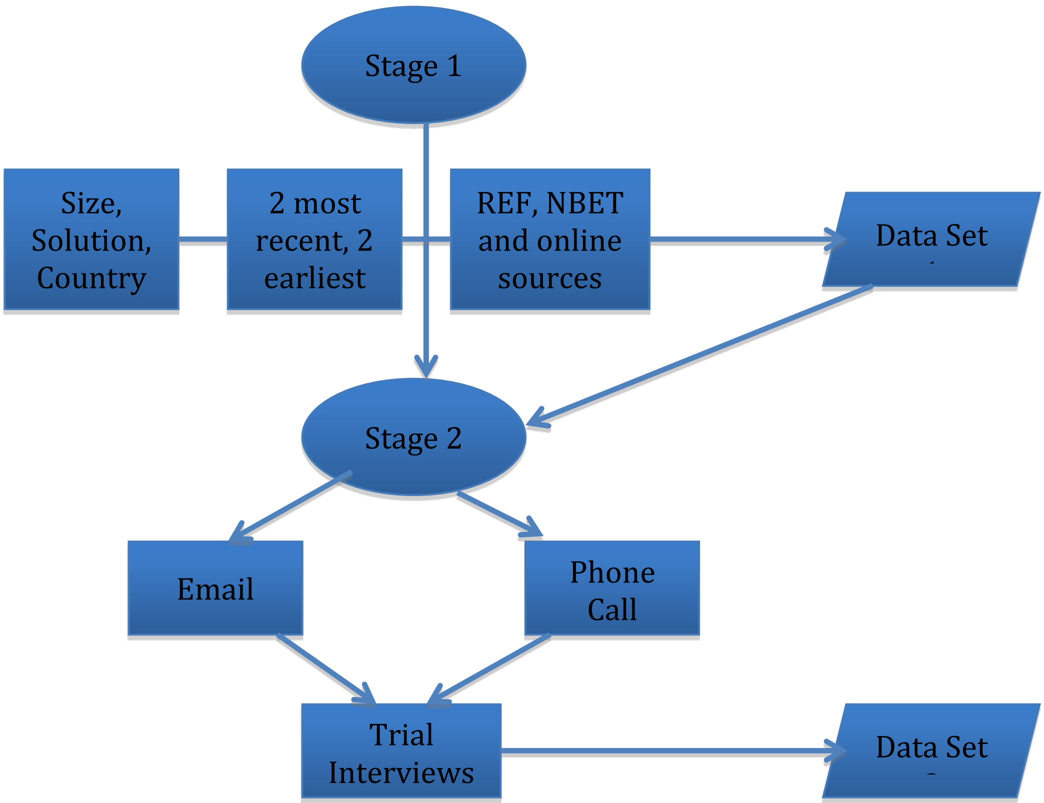
The case for renewables in Nigeria is unique with the main agents been the Independent Power Producers not the existing generating companies. Therefore we considered six (6) of the 14 IPPs with existing power purchase agreements for projects within the scale of 10MW to 200MW across the two systems of interest.

This brings the total sample size to 46 representing Utilities and IPPs in the United Kingdom and Nigeria. These 46 prospects were contacted.

4.8 Data Selection Stage 2

The pool for selection of potential participants was explored through initial contact by emails and phone calls through contact points as shared on web sites. The steps involved in the stage 1 are discussed in the earlier section with the overall description of stage 1 and stage 2 in the Figure 4.2 below.

FIGURE 4.2 flowchart of data collection structure



The second stage involved contacting the companies on the generated sample from stage 1 this was done using email addresses and phone numbers available on their websites and on the company house database.

United Kingdom

The aggregation of the large-scale wind projects gave a total of 7 utilities, which are Scottish South Energy (SSE), Scottish Power (SP), EON, EDF, ECOTRICITY, CENTRICA AND RWE with just one major solar producer Good Energy. These companies account for over fifty (50) large-scale projects; however due to response rates after several contacts the number of participants firms was three (3). The 3 were SSE, SP and EDF because they have major presence in Scotland and in the UK in general.

Nigeria

A total of 14 large-scale projects across the country were identified as shared by the Nigerian Bulk Electricity Trading Company. These projects are build and operate contracts, the companies have long-term interest for these projects. Considering that a case study approach is selected for this research, it was important to streamline the number of participants into a manageable size both for economic and accessibility reasons.

In the Nigerian case, the Nigerian Bulk Electricity Trading Agency shared the contacts of 14 companies at different stages within their development cycle, of the 14 companies contacted only 6 companies responded to the request to participate. These six had investment interest across the two renewable energy solutions of interest in different parts of the country.

Of the Six (6) reached three companies indicated interest to be a part of the research after reviewing the research brief, the contact requested for the question set and suggested that due to busy schedules telephone interviews will be preferred. The unique situation for the Nigerian sample is that they are all independent power producers. This is far different from the United Kingdom case where we had purely utilities.

4.9 Summary

The sample as obtained for the United Kingdom pool was 40 from the start; however after reaching out to the different companies there were responses for likely participation from just 1 of these companies. A preliminary test of ideas with the company as a means of verifying the ideas as captured within the body of the research was conducted. Subsequently contact was later established with 2 utility companies in addition to the 3 from Nigeria. Therefore a total of 5 companies will be considered, this in line with the total initial sample size may not be representative for quantitative and deductive study but in line with the case study approach this is appropriate since the interest is to get depth in understanding of the idea of interest (Creswell 1998).

CHAPTER 5 DATA DESCRIPTION

5.1 Introduction

In the Chapter 4, the research philosophy and methodology for executing this research to meet its objectives were discussed. The constructivist approach emerged as the most suitable in exploring and generating insights about decision-making processes and contextual influences. The relevance of this research is built around the notion that decisions are not made in isolation. They are exposed to influences that are exogenous or endogenous to the decision-making entity and are as such likely to impact on the process. One impact of interest has been effectiveness of decisions especially as it relates to the influence of environment context introducing elements such as uncertainty and risk. Here the interest is to see the influence of environmental context particular the market context on the nature of the process in terms of rationality. The organisational decision making paradigm as suggested by Simon (1985) advocates that decisions are made in complete rationality, here that position is explored against the notion that rationality is bounded by the influences around the decision maker as well as the environment. This is relevant in the renewable energy space, especially with firms attempting to expand into international markets and emerging markets seeking to attract foreign players, there is need to assess the process in general as regarding the relevance of these existing rationality theories. There is also a significant interest in establishing viability which is an integral part of the decision making process, this research addresses the decision-making and viability issue along the lines of market context. With the underlining goals of identifying divergence in process due to market context influence, establishing some sense of ranking in decision-making indicators along the lines of the firms viability interest. Achieving this therefore requires the extensive study of processes as adopted in the companies that develop renewables for that reason the case study approach was adopted.

Bougeois and Eisenhardt (1988) adopted the approach of describing in brief the case sample with the intention of justifying why they particularly are reliable to achieving the research objectives. The same approach is adopted for this section.

There were a total of 5 case studies representing the decision-making and viability assessment perspectives of 5 companies in the UK and Nigeria that have developed solar and wind projects. The case study targeted companies with large renewable energy projects (>=50MW) making it purposive, here the interest was to understand process of decision-making adopted by utilities and independent power developers and not households or small-scale developers. The UK firms that chose to participate have experience in the UK renewable energy market and have been exposed to the changes in the market. They also have large-scale renewables projects across the RES solutions (wind and solar) of interest so they fit the criteria. Also, the Nigerian firms that indicated interest shared similar characteristic with their UK counterparts in terms of project development size and are in the transitional stage of market development. The case study approach as applied here critically assesses the DMP adopted by these firms in relation to their market of operation. Therefore the DMP of the organizations within the context of application forms the phenomenon of interest. In addition to making sense of the DMP, the viability assessment framework is tested as part of the case study, offering the opportunity to assess the viability interest of the firms as well.

It is worth highlighting that the UK firms have a greater portfolio of projects having operated longer in the electricity market as compared to the Nigerian firms. The UK participants gave a general representation of their process approach making connections to recent projects decision while their Nigerian counterparts focused on the process as utilised for single unique projects.

In line with the analytical approach adopted in Chapter 4, the analysis involves the use of verbal accounts in process tracing to capture process, and market contexts with the aid of the codes as shown in the Table 4.1. This feeds into the framework for data description adopted in this chapter as shown in the Table 5.1 The description starts with a general review of the company in terms of its business interest and organisational structure where available. The framework captures the reported risks associated with projects and considered in the DMP, also represented is the market context, which has been referred to as the operational environment context. In addition, the elements of the DMP such as drivers and rationality representation are also reported within the framework. Finally, the viability assessment represented using the viability matrix is summarised on the basis of responses and how it ties to the perception of the firm's strategy. This is achieved through the analysis of transcribed interviews and documentary analysis.

TABLE 5.1 Data Field for Frame of Analysis

Risks	DMP Stimuli	DMP Approach	Viability Assessment	Indicator Matching	Project Type	Developer Type

In essence, the data contained within this section includes a brief description of the companies' interest, a descriptive representation of the DMP and the criteria/indicators adopted and finally the outcome of the test in terms of indicator prioritization from the viability framework.

5.2 Company A

5.2.1 Company Description and Project Description

Company A is an energy project development company with particular interest in the development of power projects in the mature and emerging markets. The current interest is in sub-Saharan Africa with the technology preference for solar. Company A currently owns a 50MW solar project and jointly owns two (2) other solar projects of scale 50MW and 25MW respectively. Information about company structure was unavailable, however it appeared that most of the decision making responsibility was the duty of the General Manager and her strategic partners. In this case, the respondent was the General Manager with the project of reference been the 50MW solar project located in Northern Nigeria.

5.2.2 Operating Environment (Market Context)

The market context in this research also referred to as the operational environment is part of the social system as discussed in Chapter 2 and 3 that represents the institutional and operational state of the electricity market. Three codes, market description (M-DESC), market interest (M-INT) and market stage of development (M-STAGE) developed for the capturing the market context representation are used below.

In terms of market development, the respondent was asked to classify its current market stage of development with respect to its current 50MW solar project in the Northern part of Nigeria. The respondent stated

"We are in the first stage. There's an electricity sector in Nigeria but it is one that is not yet, the commercials of the sector are challenging" (refer to Appendix 5.0D).

The market stage as reported typifies the initial market stage of development, which is captured in the Table 6.1. The existence of an initial stage indicates that markets are formed in stages and there is a market formation process; this is captured in the work of Hekkert et.al (2007) where market formation is one of the seven key functions of a technology innovation system necessary to facilitate the diffusion of any solution but in this case renewable energy solutions.

This is further strengthened by the statement of the respondent describing the market as lacking the features of a fully liberalized market driven system as captured below,

“If you go back, you talk about developers especially thermal and regulator side, there has been the transitional electricity market and contract based market where you have the full willing buyer willing seller we are not even there yet” (refer to Appendix 5.0D).

In addition, the respondent stated that it desires to operate in markets that offered certainty both financially and technically. This is captured in the statement as shown below,

“We are in the market where technical feasibility and economic viability is established but of course charity has to start from home right” (refer to Appendix 5.0B).

There is the acknowledgment by the respondent for the need to secure essential strategic interest as offered in mature markets, however the statement indicates that certainty of these are not guaranteed in the home market. The acknowledgment of the existence of an ideal market, also buttresses the point to the staged nature of markets and the expected progression through phases. Dewald and Trutter (2012) description of three market stages (nurturing, bridging and mass-market stages) and the notion as shared by the respondent points to markets are expected to progressively change offering more value to the players in the system. The neoclassical argument of profit maximization as a feature displayed by firm doesn’t stand when this case is considered since this developer chose to invest in this market.

There is a sense that the decision to develop in the respondents home market as presented is tied to the developers experience and competence within the operational environment but even with the concerns as shared, the scale of projects are far from ones handled in the initial stage of market development.

In terms of market description as it relates to the features that depict a market’s stage of development, three representation where used here; they are policy, process and technology.

The type of policy support framework applied within a market depicts its maturity, the renewable energy development space started out with grants and now has progressed to market driven contracts for mature systems. In a sense, the evidence of market transition is shown along these lines of progression. He, et al. (2016) acknowledged that in the the early stages of renewable development policies that facilitate and encourage deployment are critical, however with maturity in the sector the policies which were mainly directed at market failure correction are to be adjusted.

In the case of Company A, the respondent acknowledged the existence of policy and particularly the existence of power purchase agreements (PPA). This is noticeable in emerging market scenarios where risk hedging is provided through support schemes that guarantee return on investment.

Company A stated that the main line of financial support as provided by the operational environment is the power purchase agreement (PPA). This incentive based approach also points to the markets stage of development, as these tools are required to facilitate the effective diffusion and limit barriers to entry. Nigeria has adopted a support-driven styled approach, which is suited for emerging market scenario. So transition from one support mechanism to the other has not necessarily applied in the Nigerian case, implying also that the market has not changed.

Although, there is the existence of the PPA in the Nigerian renewable energy market space, there is an inherent investor fear in the bankability of these guarantees. Sankoma and Blanchard (2017) raised a similar issue when investigating the issues around mobilizing private finance into the development of RE in Nigeria. As part of the solution, it was advised that the liquidity challenge in the Nigerian electricity sector has to be fixed as well as policy promotion in areas of tax exemptions for potential developers.

In the case of technology the respondent stated,

"Maybe you can correct me but I don't think there's any utility scale solar project in Nigeria today, so that tells you where we are in implementation and using these technologies in Nigeria. So technology is new, competence is new, experience is new, and we will see what happens after the first projects are executed" (refer to Appendix 5.0C).

Although technology is reported as new, it is so in the sense of the developers' exposure to these solutions. The technologies been adopted were mature but were yet to be implemented on the utility scale in the country so there was a lot of learning to be done.

Finally, in terms of internal and external processes utilised in arriving at the decisions to embark on the current project, the respondent stated that although regulatory processes and requirements were in place, there were many bureaucratic challenges marring the engagement of developers and regulators refer to Appendix 5.0B, 5.0E. To that extent the market is one with processes yet to be standardized.

In summary the market stage of development can be marked a combination of features against the market stage of development as suggested by the respondent. In this Nigerian case, a depiction of the market is one, which is in its initial stage since technology and policy are been implemented on the large scale for the very first time.

5.2.3 Choice and Drivers (Stimuli for Decision-making)

With respect to choice and drivers, the decision-making literature (Mintzberg, Raisinghani and Theoret 1976; Nutt 1984) points to the existence of triggers that drive firms into deciding to develop progress. As such the triggers and stimuli that facilitate the initiation of a development project are identified in the process of tracing the decision making process. To that extent the code for motivation (MOT) is used to identify triggers. This also ties to the rationality argument of the existence of clear objectives required for taking up decisions.

The question about what motivated the decision to consider renewables in Nigeria was asked, particularly what motivated the consideration of the solar project been discussed. The respondent mentioned the need to start from the home front and as such, it identified the deficiency in power supply as a potential opportunity worth considering.

"So if there was so much deficiency in the energy and electricity supply in Nigeria, it stood to reason that we would look at the environment and beyond" (refer to Appendix 5.0A).

The constantly reported challenge of electricity in Nigeria is one that could be addressed by the adoption of renewables, alongside the climate change issue associated with fossil fuel use (Aliyu, et al. 2015; Elum and Momodu 2017).

In addition to been a business opportunity, the respondent expressed the need to solve a local problem. However in the absence of experience and unclear commercials, developer showed a lower level of risk averseness.

5.2.4 Rationality (Decision-making and market context)

Rationality in the sense as captured in the research explores process interactions for the identification of elements of comprehensiveness, people participation and standardization as stated by Papadakis et al. (1998). The aforementioned features are noticeable in processes making them appropriate markers for the extent of rationality. Three codes representing the rationality construct are used here and they are the rationality protocol (RAT-PRO), indicators (PRO-IND) and process actors (PRO-ACT). Protocols are expected to reflect the extent of rationality as applied in a process, the protocols are meant to be comprehensive, with clear set out objectives as typified in the work of Simon (1955). This is assumed to be existent in firms that have built the procedures through practice. There is an association between the presence of protocols and the existence of processes; however how this translates to process implementation is dependent on the market contexts.

When the question about process as utilized in deciding on developing the current project was asked, the respondent stated

“You really couldn’t do this whichever way you wanted because ultimately you are seeking to bring this into the project finance space and so if you are serious about developing this project you couldn’t then put the cart before the horse” (refer to Appendix 5.0B).

The above representation points to the external influence that compels developers to be procedural and as such there has to be a system that facilitates the DMP. The process as shared by the respondent included the prefeasibility, feasibility, obtaining land title, Environmental and

Sustainability Impact Assessment, Power Evacuation study, Power Price Negotiation through to Final Investment Decision (FID) (refer to Appendix 5.0F). This is the process involving both internal and external considerations leading up to the final decision to close in on the project.

A similar external process representation was presented in the work of Sakoma and Blanchard (2018) for off-grid and mini-grid projects as prescribed by the national electricity regulatory commission in Nigeria. These requirement serves as a driver for the firms in the sector to be procedural as it adds to their legitimacy.

In addition, in response to the question about how solar came to be the option of choice, the respondent mentioned that having varying options to generate from, there was the need to justify the selection of solar as the appropriate option.

"When we looked at power, there is the thermal and there is renewable. For thermal, the challenges around gas supply and related infrastructure you know impacted certain decisions around that. Then you are looking at wind, solar and hydro on the renewables side, the decision is also the ease of development and commercial viability. Ease of development, technical and commercial for all schemes as you know the realities are different. How long will it take to develop a hydro project, build a dam and all that, displacement? What does wind look like? What is the wind resource availability compared to solar? So solar ticked more boxes than the other energy sources" (refer to Appendix 5.0E).

The above representation may not be explicit in the stepwise process adopted; it however indicates the existence of a procedural approach, which involved the use of indicators to justify the adoption of solar. This is akin to a strength weakness opportunity and threat (swot) analysis approach.

In terms of decision-making research as it relates to renewables in Nigeria, the emphasis has been assessment of solutions hence the reliance on multi-criteria analysis (Diemuodeke et al. 2016; Ohunakin and Saracoglu 2018). The research direction has focused on the comparative assessment of solutions, location with little focus on the process as adopted by the firms. This does not fill in the knowledge gap in terms of identifying what decision makers classify as success factors that must be met to take up a project at the diagnostic stage of their process.

With decisions hinged on the ability of all interested player to interact within the decision making space. The decision making process involved the parent company and her partners. The respondent stated;

“And so at this time, it’s no longer the exclusive developer, we’ve signed on strategic partners with whom we are now jointly taking the project to Financial close” (refer to Appendix 5.0A).

In terms of rationality the impact of personal interests is limited in this case since the responsibility is shared amongst all participating interests. In summary, although the market stage of development as reported for the Nigerian market is classified as initial, there appears to be a high level of procedural and policy support offered in the market, the nature of policy as applied in the market of operation is suited for emerging markets. In terms of process the market stage of development did not limit the procedural nature of the development decision both internally and externally.

5.2.5 Viability assessment (Market Context)

For the current market stage as identified by the respondent, a premium is placed on the technical and functional indicators, in the words of the respondent

"Certainly technical but of course for our market technology that you haven't deployed before" (refer to Appendix 5.0J).

In addition, the need to secure funding is also mentioned as essential in the establishment of viability as compared to the emphasis on the return on investment. A dependency on the source and efficacy of technology forms a major marker for viability since these solutions are not locally sourced.

In terms of viability assessment, the three themes had representation from responses with the framework (refer to Appendix 5.1A). FIT accounting for most of the indicators while FUNCTION accounted for purely operational parameters that contributed to the achievement of the financial concerns within the FIT theme and FLEXIBILITY was the least valued in the framework.

TABLE 5.2 Data Representation for Company A

Frame of Stimuli	**Observation**	**Extracts from Interviews**
Stimuli	Opportunity	"Energy and Electricity Deficiency "
Decision-making	Logical, Centred	"assumption sheet (assumed criteria)" "consultants and General Manager" "constrained by regulators
Viability	Progressive	"there were unknowns at the local level and project level "
Stage of Market Development	Initial Market Mature Technology	Mature but yet to be adopted for utility styled project. Lack of local competencies
Risk and Sustainability	Market Risk Technology, Political	"Market risk it's been there from day one, everything else is effectively around market risks and the guarantees everybody seeks to make sense of". Technology risk corrected for using EPC's with

		experience "Political risk, that's Sovereign and the way around that is the partial risk insurance which is critical to how lenders see the project"
Viability Framework	22 fit indicators 10 functional indicators 1 Flexibility indicator	

5.3 Company B

5.3.1 Company Description and Project Perspective

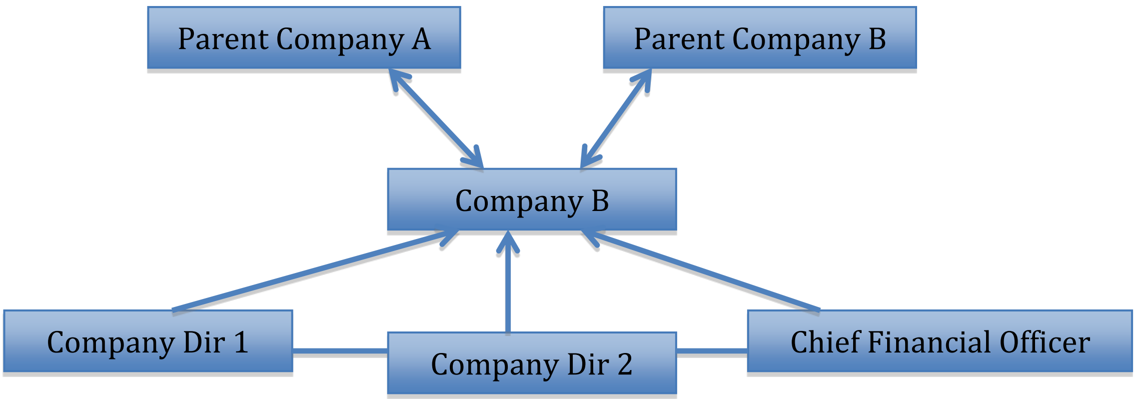
Company B is a renewable energy generation company whose primary business is to develop, acquire and operate renewable energy assets for her parent company in the UK. The technology of interest presently is wind with investments in both onshore and offshore wind, with over 25 wind farms and experience spanning over two decades. Company B in conjunction with her parent companies has built the reputation of developing both small and large-scale wind projects. As contained on the company website, projects are appraised on their ability to offer consumers competitive prices for electricity. Due to the large number of projects owned by the firm, the respondent offered a general overview of their internal decision making process as it applies to projects. This is logical since over time it can be assumed that standardised systems must have been built for use when projects are considered.

5.3.2 Organizational Structure

Company B is a joint venture between two parent companies under a 50:50 arrangement as shown in Appendix 2.0 and 2.3A. Company B was created in 2008 as a business unit to handle the development of renewable energy solutions on behalf of the parent companies shown in Appendix

2.2A. The parent companies contribute skill, expertise and resources in the bid to harness resource, opportunities in the UK. The company structure as captured under the company house directory for Company B is shown in Figure 5.1. It has a mix of staff from both parent companies holding positions of company director and chief financial officers respectively. Consequently, it is assumed that since the company is joint venture the development decisions will be hierarchical as it moves from Company B up through to the parent entities.

FIGURE 5.1 Company B Organizational Structure



Source: Company B archives and interviews

The Figure 5.1 above shows the structure and the likely decision making pathway for Company B. The choice of renewable energy solutions and projects emanate from the activities of the development units within Company B under the guidance and supervision of Company Directors and Chief Financial Officer. However, final investment decision is taken at the level of arrived consensus by both parent companies after extensive analysis at the subsidiary level while project execution takes place at the subsidiary level.

5.3.3 Operating Environment (Market Context)

The respondent view of market context with respect to the market features of market stage of development, market of interest and market description are discussed below, these features were chosen since they are considered to offer an insight into the market context.

In terms of market description, the three features used to describe the market were policy, technology and process. Beginning with policy, the respondent was asked about its policy experience in the UK market. The respondent acknowledged the existence of policy that offered market support while mentioning the transition in the nature of policy in the UK renewable electricity market.

“At the current time all of those wind farms operate with either renewable obligation support or contract for difference” (refer to Appendix 2.2B).

The above statement points to the existence of policy support while indicating change not just in the policies but also in their function. The newer policies are meant to move the UK market more towards a purely market-driven system where competition is the basis for participation in the market.

The UK renewable energy policy space has undergone change from the introduction of NFFO in 1990, which was reported as non-effective in driving the diffusion of renewable (Mitchell and Connor 2004) to the introduction of the RO and now to the CFD. There is a noticeable transition in policy to even out cost of support as currently handled by the regulators.

In terms of technology, there was no clear mention of level of maturity in technology adopted. However, there was a subtle association between technology used and the market maturity that can be drawn from the account of the respondent. The respondent stated

"We are clearly in the mature stage for the majority of our activities. We have a fleet of 30 or more wind farms, a couple of which are offshore" (refer to Appendix 2.2B).

"But you then get what we are doing going beyond that in terms of developing wind farms and probably some other types of renewables at least in the evolving scenario" (refer to Appendix 2.2B).

The mature market scenario was associated with the onshore while offshore wind technology is considered to be developing options within the UK. On the other hand, other renewable energy options that include battery storage are associated with the initial and emerging markets, these technologies are still new in terms of their adoption. Although not explicitly stated, this case indicates the flexibility in technology options as adopted, with mature through emerging technologies associated with Company B.

The categorisation of technologies into mature and developing as found here, is similar to the UK government's CFD technology categorisation. Three technology groups namely established, less established and others were reported, with onshore wind and offshore wind categorised into established and less established respectively (Baker 2016). Although onshore is mature as referenced in the interview, the firm also engages with other technology options which gives them the first mover advantage as early adopters.

Another pointer to the level of maturity of technology used and the progressive adjustment in terms of maturity is shown in the project development approach adopted by Company B. The development approach was one that was consciously anchored on building competence by developing small projects to now large-scale projects. The respondent mentioned that a significant change in their development trajectory was hinged on the large acquisitions.

“What has happened is its been a case of 10years ago we started with relatively small wind farms and built business form there, Go back to kirkinton haven’t you which is the smallest wind farm in our fleet and then developing wind farms around kind off 10-15MW. A little bit of game changer in 2010 and 2011 when we purchased a consented wind farm project called falligo rig. It’s 144MW; we bought it as a consented wind farm and built it. This kind of overnight doubled our operational capacity” (refer to Appendix 2.3B).

The respondent reported that Company B is currently placed in the mature stage of development in most of its onshore and offshore projects as shown in Appendix 2.2B and Appendix 2.3A as discussed above; this is based on the level of experience gained and the state of technology used. However, it is reported that there are attempts to introduce newer solutions and alternatives that present an improved business proposition for Company B as shown in Appendix 2.3B and Appendix 2.2C. Example was given of the introduction of battery storage. Similarly, a point was made for the potential consideration of solar farms, which is currently not considered by Company B in the UK.

In terms of processes, the respondent was asked to describe the internal and external processes adopted as it relates to its projects, the respondent indicated that development starts with the identification of opportunity then feasibility all the way through to FID. The respondent stated

“An opportunity arises to develop a wind farm on a particular piece of land, we will go through the initial feasibility stage, we will probably take a fairly bullish approach we will factor in any known constraints we know” (refer to Appendix 2.3E).

The above statement indicates that the company continuously engages in search for opportunities, which is tied to availability of resource and land. This is logical since the mission of Company B primarily is to develop clean energy projects in an attempt to meet the clean energy obligation as mandated on its parent company, a licensed electricity supplier in the UK.

5.3.4 Choice and Drivers (Stimuli for Decision-making)

Development of renewable solution forms the core mandate of Company B as part of its deliverable to her parent company on its expected clean energy obligation as stipulated for energy suppliers in the UK. The motivation for developing renewables can be associated with both strategic and regulatory stimuli. The respondent stated;

"We are a company that builds and operates renewable generating machines (refer to Appendix 2.2B)."

The development of renewables is a core mandate for Company B.

"It is more in terms of Company B's energy requirement as generators, they are required to work as far as they can in terms of the renewable obligation" Appendix 2.3.

Therefore regulatory and policy requirement act as the core driver for the renewable development choice as shown in Appendix 2.2B.

The overarching need by the UK to meet its climate change and emission targets facilitated the move towards the transition the UK energy economy to be a low carbon economy. As part of the approaches, the mandatory requirement of supplies of electricity to account for their clean energy contribution has created the need to generate from clean sources or acquire renewable energy certificates. This regulatory push is one major influencer of the adoption of renewable in the UK, there are similar regulatory or target driven mandates in different countries.

5.3.5 Rationality (Decision-making and Market Context)

In using the convention as prescribed for this research, rationality should be represented by three core factors; they are rationality protocol, indicators and process actors. The company process and its evaluation strategy as applied for projects are the markers of the existence of a rationality protocol, however its extensiveness is a reflection of the comprehensiveness of the protocol.

It was mentioned earlier by the respondent that there is a clear development mandate to develop as much renewable energy solutions as possible. In the words of the respondent,

"So basically the objective has been to produce as much renewable electricity as we reasonably could do while meeting Company B's investment criteria"(refer to Appendix 2.3C).

The aforementioned statement points to the existence of a set of investment criteria which is essentially part of a process that leads to the decision to develop projects. Essentially decisions have to be inline with the set out guidelines of the company. Similarly, the respondent also acknowledged the existence of a clearly defined process used for arriving at decision. The continuous refinement of criteria and the existence of hierarchy of authority typify the process.

"An opportunity arises to develop a wind farm on a particular piece of land we will go through the initial feasibility stage, we will probably take a fairly bullish approach we will factor in any known constraints we know"(refer to Appendix 2.3E).

From the above, there exists an approach for establishing suitability of a project with the use of decision-factors. However the statement about known constraints indicates the existence of unknown constraints, which faults the complete information argument of the rationality theory.

Consequently in terms of rationality indicators, the respondent stated a few factors considered as mentioned below

“We apply constraints we have, spacing between turbines, we do not want to be close to residential properties, avoid sites of scientific interest, and we will take a rough but bullish approach. A rough assessment of how many turbines can be accommodated? What size of turbines? What generating capacity? What we know about the wind resource?” (refer to Appendix 2.3E).

This forms the basis for the identification and selection of a potential development project, the existence approach and evaluation methodology points to the rationality as applied in this case.

Finally, the decision to take up an identified opportunity into the portfolio is taken at the director level of Company B based on the facts generated off analysis however the FID is taken at the board level both parent companies. The process of project development is gated from the process inception to the FID, the process as shared by the respondent.

5.3.6 Viability assessment (Market Context)

In line with the viability framework the respondents shared the strategic and operational expectations and requirements on proposed projects, these were matched against indicators as contained within the viability matrix framework (refer to Appendix 2.3G and 2.3H). In terms of strategic requirements the respondent identified that grid connection cost, wind resource availability, land availability and environmental impact make up a critical set of factors considered. These are critical in the words of the respondent to move project out of the Bronze stage. Extensive economic and financial analysis using grid connection cost, estimated operating cost, development cost into the determination of the Net Present Value, Internal Rate of Return and Payback are conducted in the silver stage. There exist thresholds as utilized by Company B, which have to be met for progression through stages.

Further refinement happens in the gold stage with the access to newer and more accurate development information for progression into the platinum stage where FID is made. However functional and operational indicators as identified by the respondent included Grid availability, Technology type selection (Best Price, Best Kind at the Least cost of operation and maintenance) and maturity and human resource.

In terms of the flexibility theme, the respondent compared their kind of investments to the development of hydro-assets where change and alterations are not quite implementable especially on the scale of size and operations (refer to Appendix 2.3K). An example was given by the respondent contrasting wind projects to solar farm where new and more efficient panels can be replaced or reoriented with much more ease. Also mentioned was the challenge with wind projects in the case of extensions, which require planning permissions regardless of the scale of change. The orientation concern and modularity features as found with solar are not obtainable for wind, in the words of the respondent "you can't go back to change positions, you stuck with them for 20-25years" shown in Appendix 2.3L.

TABLE 5.3 Data Representation for Company B

Frame of reference	**Observation**	**Extracts from Interviews**
Stimuli	Opportunity / Problem	"Guaranteed Power Price from Parent company " "Support Policy"
Decision-Making	Logical, Hierarchical	"assumption sheet (assumed criteria)" "involvement of directors and board" "use of internally defined indicators"
Viability	Staged and Progressive	"initial concept to project development through project refinement" "process has become tighter with the removal of subsidy" "use of internally defined indicators"
Stage of Market Development	Once Mature but deteriorating into an Emerging Market Mature Technology	"tried and tested technology" "investment without support is not looking easy" "need of long-term signal"
Risk and Sustainability	Technical, Construction risk, Environmental Impact	"sights which are like European breeding ground for rare birds" "site in the lake distract national park its not going to get consent"
VIABILITY FRAMEWORK	16 fit indicators 7 functional indicators	

5.4 Company C

5.4.1 Company Description and Project Perspective

Company C is a vertically integrated utility company with business interest in the oil and gas, electricity generation, distribution and transmission, communication and construction as shown in Appendix 3.0. The far-reaching involvement of Company C makes her one of the most versatile in the business space in the United Kingdom.

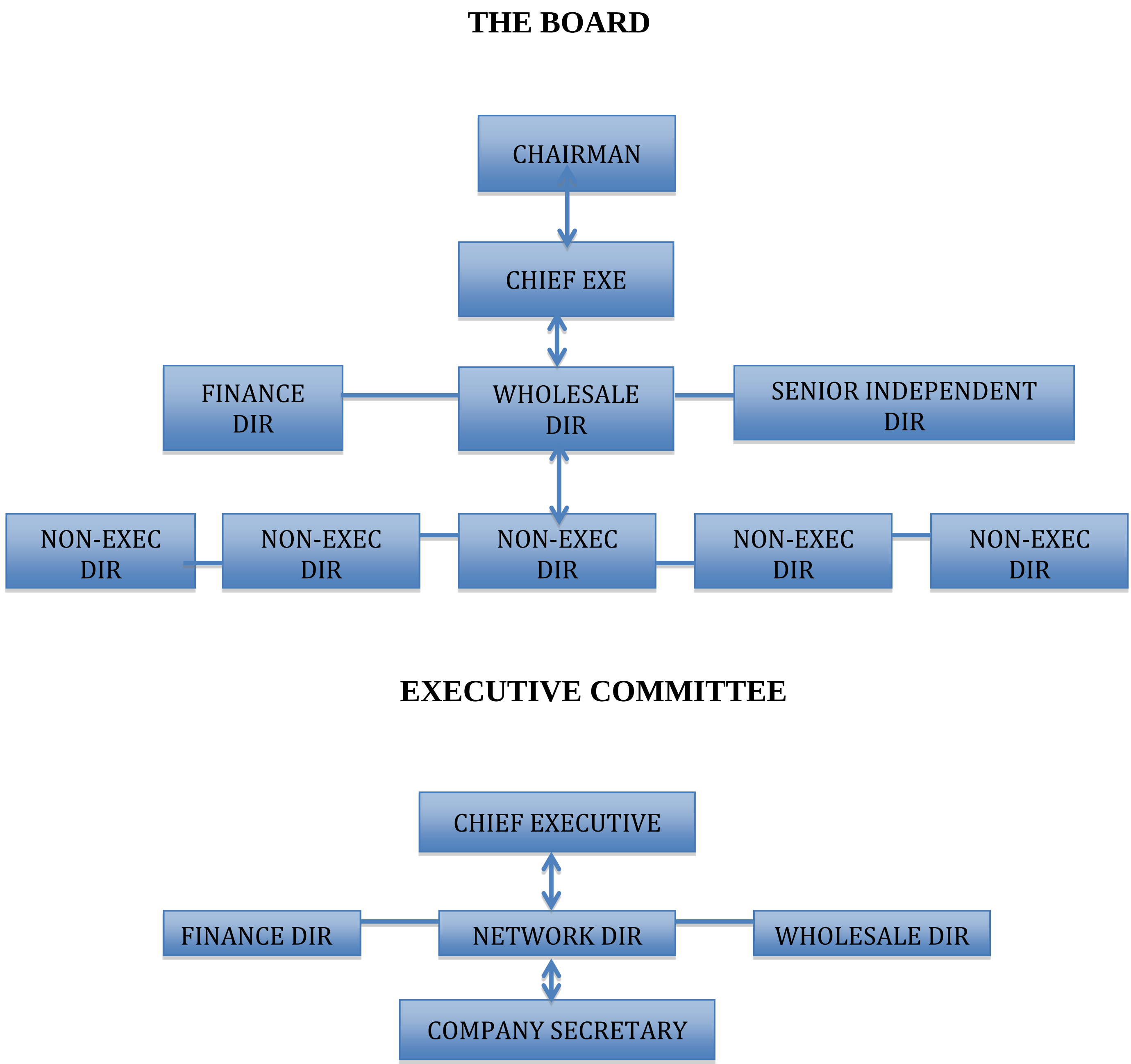
The respondent in the description of the company used the term vertically integrated to indicate its breadth and depth in operation. Breadth was shown in the reach across different business interest and depth was shown in the sense of interconnection and interdependency between different facets of the business as shown in Appendix 3.2A. Hence this directly affects the company decision-making and policy activities. The project representation was one that was more generalised in this case with particular references to unique projects.

5.4.2 Organizational Structure

Company C has staff strength of over 20,000, with 10 board executives making up the management of the company. These individuals are directly responsible for conducting good and sound business on-behalf of Company C shareholders while specifically handling matters on strategy, budget and major investments. In addition to the board, there also is the executive committee, which is directly involved in strategy and policy implementation as agreed by the board. This team is made up of 5 individuals, the Chief Executive, Directors of Finance, Wholesale and Networks in addition to the Company strategy. So the Board and Executive Committee as displayed in Figure 5.2 handles the business of

Company C from the strategy development and implementation perspective as shown in Appendix 3.0 and 3.1D.

FIGURE 5.2 Company C Organizational Structure



Source: Company C archives

5.4.3 Operating Environment (Market Context)

The renewable energy development focus of the company has been in hydro, onshore and offshore wind particularly in the UK, these have been a combination of developments from the scratch, acquisitions of consented projects and acquisitions of companies. In describing the operating environment, the market description, market interest and market stage of development convention is used here.

The market description feature is expressed as a combination of three factors policy, technology and process dimensions associated with the development.

Starting out with questions about the policy dimension experience in the UK market, the respondent stated,

"The existence of market support for the development of these solution has acted as an incentive for the investment, however the introduction of the contract for difference has changed the investment trend" (refer Appendix 3.2C).

"I think from our perspective we need a long-term signal that's the first thing so renewable obligation and contract for difference gives a decent level of certainty" (refer to Appendix 3.2H).

These above statements point to the existence of clearly defined policies which are intended to support the development of RE. However transition in policy is noticed with the introduction of the CFD's, which moves the market to a more market-driven system. This points to the intended motion of the market towards maturity but the respondent associated these changes with uncertainty that potentially could affect investment trends.

"In addition the development of policy and reduction in certain subsidies add to the inertia to expand" (refer to Appendix 3.2E).

"However the CFD's are different as you don't know exactly how much and when the options will be made public. The government has contributed to the uncertainty which does not help in planning" (refer to Appendix 3.2H).

The policy direction in the UK has been one that has been reflected in the way company C has taken up renewable projects. It has progressively adjusted its development interest in line with the policies and supports as introduced by the government. Company C acknowledged having participating in the RO certificate mechanism, which was reported to have been successful in fast tracking the development of onshore and onshore wind (Bunn and Yusupov 2015). However there has been a change in support with the RO ending in 2014 hence leading to the introduction of CFD's, which are meant to make the market more competitive and share the cost risk of the regulators.

In terms of technology adopted, which is the second factor associated with the market context representation, the respondent was asked about its technology of interest. It pointed to its origin, which is hydropower generation. The approach to development has been conscious with the movement from hydro to wind, capturing in a sense the expectation of efficacy of technology before adoption. This is shown in the statements of the respondent,

"We go for what is pretty much tried and tested as an entity, which is not a disservice to our brand as we deliberately do not pioneer cutting edge options" (refer to Appendix 3.2D).

"With respect to market presence it is also important to compete effectively with contemporaries as such been best in class in terms of what and how solution are delivered" (refer to Appendix 3.2C).

“We have been working with Siemens and General Electric lately but in essence there are 2 or 3 big manufactures that we would look at especially with them been able to deliver solutions to scale” (refer to Appendix 3.2D).

This points to the earlier reliance on hydro which is an established solution and the gradual progression in to wind.

Finally for technology applied the respondent stated

“We don’t engage in trying left field technology” (refer to Appendix 3.2D).

This shows that in terms of development, the adoption of mature, tried and tested solutions is an essential criteria considered in the development of any renewable energy project. This position of adopting solutions that have proven track record may be considered as a risk averse behaviour displayed by the firm, which may translate to loss in market share. On the other hand the firm has a reputation to maintain as such considers the strategic fit of solutions to its overall ethos.

The final feature of market description concerns process, the question about process adopted in arriving at a decision to develop a project was asked. The respondent mentioned there are clearly defined internal and external processes.

“So it’s a business case, ultimately its got to meet a number of criteria. What you will do for any project effectively is conduct an investment appraisal” (refer to Appendix 3.2I and 3.2J).

“In majority of the cases it will be a tender process, the tender process involves the major manufactures such as Siemens and General Electric” (refer to Appendix 3.2D).

In terms of market interest, the responses show that Company C is risk averse in its development interest as such develops in markets that a classified as mature.

“We have looked in the past I think and continue to look at wider jurisdictions than just our core area just now but there’s no sort of radical departure from sticking to the UK and Ireland” (refer to Appendix 3.2C).

The final feature of market context is the representation of the market stage of development as reported by the respondent. This was not explicitly stated but there is a sense that the development environment in terms of technologies adopted are classified as mature but in terms of policies the market still is not purely market driven in the UK. This is drawn from the comparison of the UK to Germany made by the respondent.

“You will see the onshore wind is all about out the other side and currently working subsidy free in Germany” (refer to Appendix 3.2H).

The aforementioned indicates that the respondent considers its current market to be less mature since it still depends on policy support to secure return on investment.

In summary, Company C has situated its operation in the UK and Ireland because it considers the market mature enough for its operations. However in comparison to other Germany in particular, it considers its self less mature on the basis of its inability to thrive in the absence of financial policy support. In terms of applied technology, it only implements solutions that are considered matured and commercially tested.

5.4.4 Choice and Drivers (Stimuli for Decision-making)

The choice to develop renewables has been entrenched into the ethos Company C, starting out with hydro as its initial generation option as formally the Hydro Board. In the words of the respondent

"Located in Scotland its geographical location presents a set of natural assets that could be harnessed in the area of wind as such this drove the interest in wind" (refer to Appendix 3.1A and 3.2B).

"It was purely opportunistic using the available resources as found in the surrounding and maximizing it" (refer to Appendix 3.2F).

Resource availability and acquired competence contributed significantly in the motion towards wind development. These presented opportunities that Company C chose to capitalize on. This builds on the resource-based theory of the firm where firms build their advantage on the basis of what they consider as resources at their disposal. The notion that products differentiate firms is not one that is necessarily applicable in the business case for electricity since the core commodity is homogeneous. Making the case for the reliance on other sources of advantage in this case resources which also facilitates the reduction of transaction cost that enhances the return on investment for the firm (Wernerfelt 1984;Hitt et.al, 2016).

There also was the argument for diversification of portfolio, the respondent stated

"I think it is a bit of both, we have a balance of electricity generation, you know often when it is rainy then it is good for hydro. It is windy in the North of Scotland it is good for onshore and offshore wind" (refer to Appendix 3.2B and 3.0).

It points to the strategic intent of having a range of options in the generation suite. In addition to resource availability and strategic intent, the existence of renewable obligation and subsidies also compelled and facilitated the development. Respondent said,

“The existence of market support for the development has acted as an incentive for investment” (refer to Appendix 3.2C).

Therefore, opportunity and the existence of a crisis defined choice.

5.4.5 Rationality (Decision-making and Market Context)

The rationality dimension builds on the notion that process rationality is depicted by the existence of a decision making protocol, actors involvement and information availability. In this case the respondent reported the existence of protocol used in the definition of a probable projects as well as for the selection of technology.

When asked about the process adopted in deciding on a project, the respondent stated

“What we’ll do for any project effectively is investment appraisal checking the viability of the project equally it might be a fantastic project from a project return point of view but might completely contradict everything we are doing within the sustainable space” (refer to Appendix 3.2J).

“In terms of process it’s probably two tiers from start of say concept to final decision as in go or no go, the point is trying to increase certainty and understand what the risks are” (refer to Appendix 3.2J).

The statements above show the existence of a standard approach adopted for all projects. In addition there is a conscious effort to capture elements outside of economic benefits as highlighted with an emphasis on promoting sustainability. Therefore, there is a mix in use of value and fact in the judgment of project viability.

Another indication of the procedural nature of process is highlighted in the respondent statement about progressive refinement.

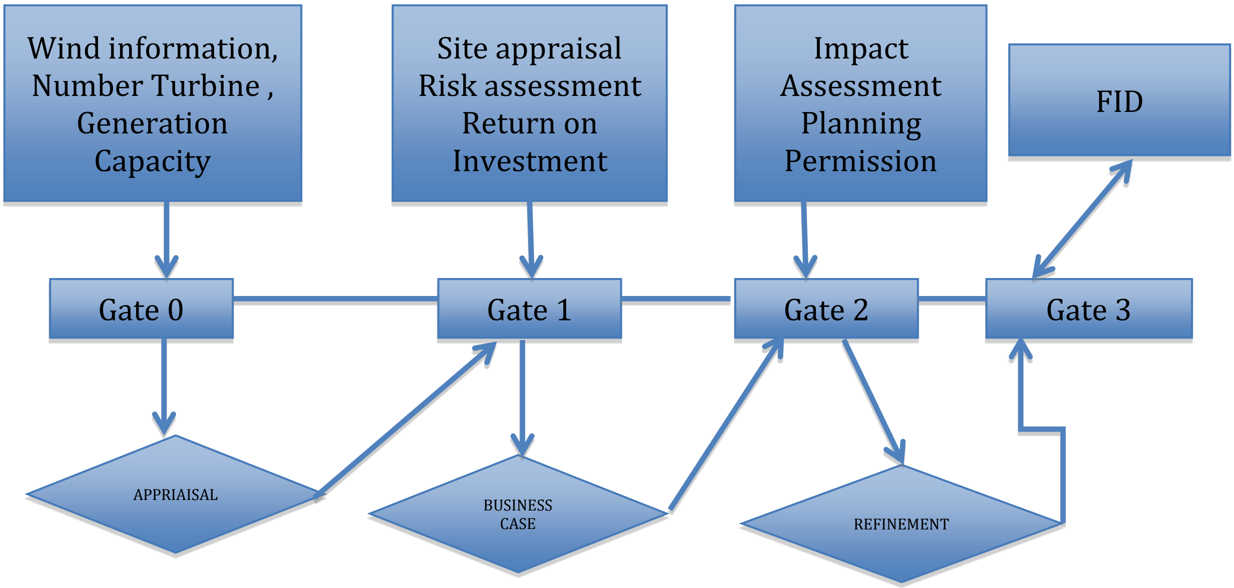
“From concept all the way, clarity is gained with growing detail, continuous refinement leads analysis to the point of go or no-go” (refer to Appendix 3.2J).

As a matter of principle the firm works with budgetary margins which introduces a level of constraint in definition of choices, the second level of constraint is the knowledge and experience factor. The firm will rather be effective by been best in class with its contemporaries than take up left field projects. The third level of constraint is project cost, so for projects above a particular price point the involvement of the board is required, this captured in the statement below.

“So our process, any project over £10million needs to go through this process, typically the big ones are £50million and above” (refer to Appendix 3.2J).

These are the high-level layers of rationality as described by the respondents however on a project-to-project basis; it is more a risk measure and uncertainty reduction approach that is adopted for effective decision-making. Figure 5.4 below shows the process flow as shared by the respondent.

FIGURE 5.4 Project Process Diagram Company C



Source: Company C Interviews

In terms of indicators applied in the process, the respondent stated,

"The approach in line with investment has been one of managed expectation working from the known to the unknown with growing amount of information and reduced uncertainty" (refer to Appendix 3.2C). The notion that information is available as suggested in the rationality argument is faulted. The process involves known and unknowns with progressive refinement. Company C works with available information while progressively searching for more information to facilitate the decision.

The final factor considered in the rationality dimension is the actor involvement, the nature of the firm as shown in the organisational structure suggests a hierarchical ordering within the firm. As it relates to the decision on projects, the board have the final say on projects, which have gone through scrutiny at low-level of management. So the decision to take up a project starts with the emergence of a prospect, which is managed by low-level management with the job of thorough appraisal and evaluation. After which it progresses to the capital allocation group or the board depending on the value of the project for final investment decision, which is made on the basis of facts and organisational value.

In summary, Company C has its standardised approach to decision making for projects that is progressive and procedural regardless of the associated concerns in changes within its operational environment. The operational environment certainly affects the way decisions are made as it has been stated that refinement with emerging information facilitates the process. However in terms of the procedural nature, a standardised approach is in existence

5.4.6 Viability Assessment (Market Context)

Market development representation as understood by the respondents was more of the process stages as compared to the context within which the decision is been made. Therefore there was a failing in mapping the different decision making criteria to different stages of development. The respondents had a consensus position that decisions of the company first had to consider strategic relevance before any other functional factors. However, respondents mentioned flexibility in terms of reuse of sites as a fundamental element in decision making since sustainability formed a core part of the value offering of the company. A brief summary of the findings is presented in Table 5.4 below.

TABLE 5.4 Data Representation for Company C

Frame of reference	Observation	Extracts from interviews
Stimuli	Opportunity / Crisis	"our geography presents us development opportunities onshore and offshore wind " "Support Policy"
Decision-making	Logical, Hierarchical	"use of tender process" "use of internally defined indicators"
Viability	Gated and Progressive	"initial concept to project development through project refinement"
Stage of Market Development	Emerging Market Mature Technology	"tried and tested technology" "investment without support is not looking easy" "need of long-term signal"
Risk and Sustainability	Technical, Construction and Contractual risk	

5.5 Company D

5.5.1 Company Description and Project Perspective

Company D is a renewable power generation company with particular interest in the development of solar in Nigeria with interest in expanding through projects in Sub-Saharan Africa. A clear organizational structure was not available. The project and process perspective as presented applies to the 50MW solar project currently in construction in the northern part of Nigeria.

5.5.2 Operating Environment (Market Context)

The convention adopted for representation of market context captures market description, market of interest and reported market stage of development. Market description is categorised into three elements policy, technology and process.

In terms of policy, the respondent was asked about policy experience in the market, there was a general acknowledgement of the existence of policies and risk support schemes, which are expected to correct the risk faced by developers.

“You have a government sign an agreement that is supposed to last twenty years you are not gone even into the first year thy have changed the agreements” (refer to Appendix 4.0B).

“We had already signed those power purchase agreement” (refer to Appendix 4.0H).

By the peculiar nature of PPA’s, these agreements are purely built to promote the economic viability of projects, which is in tune with standards adopted in mature and emerging markets, of which Nigeria is far from. Additional incentives for developers and investors include the Partial Risk Guarantee and the Put Call Option Agreement that offer risk correction opportunities and increases the level of confidence to proceed with development. The PCOA was set up by NBET as a risk cushion for developers of renewables in Nigeria in the event of termination that the government would acquire the assets and ensure all debts are paid.

Although the existence of policy is acknowledged the respondent expressed concerns with the constant change as initiated by the government.

“In Nigeria there has been policy somersault at every point in time, I have experienced it” (refer to Appendix 4.0B).

The above statement was reiterated in the work of Sakoma and Blanchard (2018, p7) “ whilst energy policies as outlined earlier, have been created by the government, their follow-up and active execution have been lacking”. This representation shows that investment or development in this market will be challenging, the associated policy uncertainty has the potential of hampering the rapid adoption of RE in Nigeria

In the area of technology adopted, the respondent equated technology maturity with the competence of the providers of the solutions.

“Our contractor is one that has not only built power plant before but they are building power plants in Africa and they have a track record” (refer to Appendix 4.0F).

The absence of local technology and skilled manpower in the sector has facilitated the dependence on experts and foreign technology similar to the oil and gas sector in the country. This in itself is a potential barrier to the development of the sector since additional cost on import and fluctuating foreign exchange prices have a direct effect the total cost of project implementation.

In terms of process, the internal processes used by company D was far from explicit and comprehensive, however the external process defined by the regulators was comprehensive. The respondent mentioned that decision-making is marred by the continuous change in policy and bureaucratic bottlenecks. The respondent gave an illustration as shown below,

“For example you are supposed to go in 30day, everybody is waiting on the agreement to give me financial close. For 30 days you don’t get that agreement for one year what do you do” (refer to Appendix 4.0B).

“You find out that even documentation process for a project is taking 4years this shouldn’t take more than 6 months but its taking 4 years, and then when you finish documentation you have policy somersault” (refer to Appendix 4.0B).

To the question about market of stage of development, the respondent for Company D did not state explicitly where it situates its market of operation however by association the market shares semblance with the emerging and mature stage if process, policy type and technology are used. According to the consideration of technology, support and process, the respondent acknowledged that the technology in use was mature however untested within the local terrain.

In terms of the market of interest, the respondent was interested in identifying opportunities as such the term sector viability was used to represent market of interest. However the choice of Nigeria does not necessarily offer viability in the purely economic forms due to the challenges associated with infrastructure and institutional failings.

In summary, the market context as capture from the exchanges shares features of an emerging market in the areas of technology adopted and in the policy with uncertainty associated with the existing institutional framework. Underlining these is the existence of process as stipulated by the regulatory agencies and a far from formal representation of the internal process as adopted by the firm. From the accounts as presented there is significant influence associated on the process of decision making by the market of operation.

5.5.3 Choice and Drivers (Stimuli for Decision-making)

The motivation and drivers for the development of renewables considered by the Company D are, opportunistic, economic and nationalistic. The respondent acknowledged that captive forms of energy generation were more expensive relative to renewables.

“Anybody entering the power sector as long as you can deliver generation today there is opportunity” (refer to Appendix 4.0B).

"The Captive ones you can generate with, generators with gas all these, but it is expensive" (refer to Appendix 4.0B).

"We are 200 million people we have total power generated 4gigawatts, at our very best we have generated 5, lets give us 6. 6gigawatt if we multiply that to the number of people we are grossly underserved in terms of electricity. Bottom line the market exists" (refer to Appendix 4.0A).

It is worth mentioning that the respondent also shared concerns about the need for resilience, "A lot of people backed out of the challenges but again you have nationals like us" so there is also a sense of responsibility shared by the respondent shown in Appendix 4.0B.

5.5.4 Rationality (Decision-making and Market Context)

The rationality dimension as noticed in this case builds on the nature of the firm. When the question about the internal process was asked, the respondent stated

"What you have to understand you are asking an entrepreneur developer, you are not asking a CEO of a company they are two different things" (refer to Appendix 4.0E).

In essence the decisions and definition of objectives rested solely on the respondent who was the managing director at the time. This is shown in the response when the question about process was asked.

"Like I said right, every time you building up a project, you have to consider all of that before. I considered, look what are the challenges and requirement to run this plant yes. Where will I run this plant, this is how it operates, what do I need to do to get this plant operational. So you consider in terms of development everything and yes even though I know, I have to operate this plant for 20years what are the things that will stop me or enhance me in operating for 20years" (refer to Appendix 4.0D).

The person centric approach adopted did not affect the execution of internal processes partly because the internal processes are dependent on external process requirements. The respondent reported the adoption of procedural approaches such as request for proposals in the case of shopping for Engineering Procurement and Construction companies. In addition, in areas such as ESIA specific standard procedures required the expertise of consultants and external partners (refer to Appendix 4.0F).

However in terms of establishing basis for moving into the Nigerian electricity market, it was more intuitive on the part of the respondent. This was built on the premise that opportunity existed to meet electricity deficiency (as shown in Appendix 4.0A).

The respondent addressed the question of indicators used in the process by stating factors that were considered; they include technology, cost, resource availability, revenue, government support and risks.

Finally, the nature of the firm points to the dependency on the entrepreneur developer as the main actor pioneering major decisions as regarding projects.

5.5.5 Viability assessment (Market Context)

The respondent mentioned 3 categories of interest, which defines the viability of a project, the existence of a market, the availability of 1st Tier Solution and the management of the operations. In addition, the respondent mentioned resource availability and risk correction mechanism through EPC and O&M contracts. The respondent stated that access to funding was not necessarily a concern since capital seeks for investment as long as return is guaranteed however risk correction through contracts and long-term PPA's form the hedge for making progress with investments as shown in Appendix 4.0D.

In terms of the viability framework it more indicators were associated to the FIT theme as a basis for confirming sector viability and FUNCTIONAL indicators confirming the ability to meet the FIT as well as financial expectation. The respondent did not consider the FLEXIBILITY theme. Finally the Table 5.5 below summarizes the findings.

TABLE 5.5 Data Representation for Company D

Frame of Reference	Observation	Extracts from Interviews
Stimuli	Opportunity	“Anybody entering the power sector as long as you can deliver generation today, there’s opportunity”
Decision Making	Logical, Centred	“I have considered all the risks”
Viability	Procedural	“we ran a tender”
Stage of Market Development	Mature Market Mature Technology	“I have a guarantee from an EPC”
Risk and Sustainability	Technical, Construction risk, Environmental Impact	
Viability Framework	15 fit indicators 7 functional indicators	

5.6 Company E

5.6.1 Company Description and Project Perspective

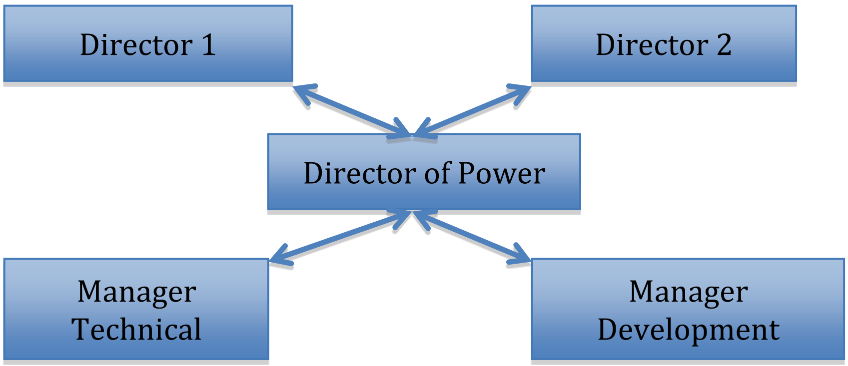
Company E is a Greenfield development partner with interest in developing renewable energy infrastructure and solutions in Sub-Saharan Africa.

A quote from the company profile describes the firm as “technology agnostic” making the firm flexible to different technology options (refer to Appendix 1.0A). This strategy seeks to match solutions to local needs as such prioritizing interest using local environmental and operational conditions. With over 75 years of experience in the energy sector and close to a decade of experience in the Nigerian Power sector, Company E has gained experience and a reputation as consultants and knowledge provider. In the Nigerian case, Company E was a support partner during the deregulation programme that led to the breaking down of state monopolies in the electricity sector in 2010. Company E is currently involved in developing an 80MW ground mounted solar photovoltaic project in Nigeria that is in its late phase of development, as shown in Appendix 1.1A.

5.6.2 Organizational Structure

As a subsidiary of a larger parent company, Company E shares an overall supervision from the parent group, however the technical and development managers of company E assume the core functions of decision-making in terms of projects within the electricity generation portfolio but they report to the Global Director of Power who in turn reports to the directors from the parent company. Figure 5.4 below shows the structure.

FIGURE 5.4 Company E Organizational Structure



Source: Company E archives and interviews

In Africa the Parent Company has sealed transactions worth $10 billion over the last 20 years.

5.6.3 Operating Environment (Market Context)

The respondent considered the market development description as representative acknowledging the varying three stages of market development. The project in focus was located in Northern Nigeria. It is Company E's first renewable (solar) project in Nigeria although they have been involved in delivering other power consulting services in the country.

In terms of the market description, the policy offering was the PPA as reported by the respondent, which was mentioned as a requirement in the decision process. From the technology perspective, the adopted technologies were classified as mature but untested in the local conditions. Finally in terms of market description, on the process element, the respondent mentioned the lack of clearly defined processes. This points to the processes involving external engagements with the regulatory agencies within the sector as the respondent mentioned that Company E had standardised internal processes. The respondent indicated that the lack of a formalized or standardized market procedure was a reason for strained negotiations and hesitation to commitment on the project as shown in (refer to Appendix 1.1A).

The next factor that describes the operating environment was the company's market of interest. The firm has a particular interest in clean power projects in predominantly markets in their initial and emerging stages of market development (refer to Appendix 1.0A and 1.1A) making Nigeria suitable for its operation.

Finally, the respondent shared that features that mark the market stage of developments include the entrepreneurial nature of the project, which is been implemented in the absence of any local power development expertise and the absence of a formalized or standard market procedure. On that note it considers the Nigeria renewable energy market to be in its initial stage of market development.

5.6.4 Choice and Drivers (Stimuli for Decision-making)

The respondent stated that the choice to invest in Nigeria and the choice of solar was driven by intuition, experience and resource availability respectively as shown in Appendix 1.1B. This approach to decision making fits the context where information is not readily available and experience particularly in the sector cannot be accessed by the performance of a competitor.

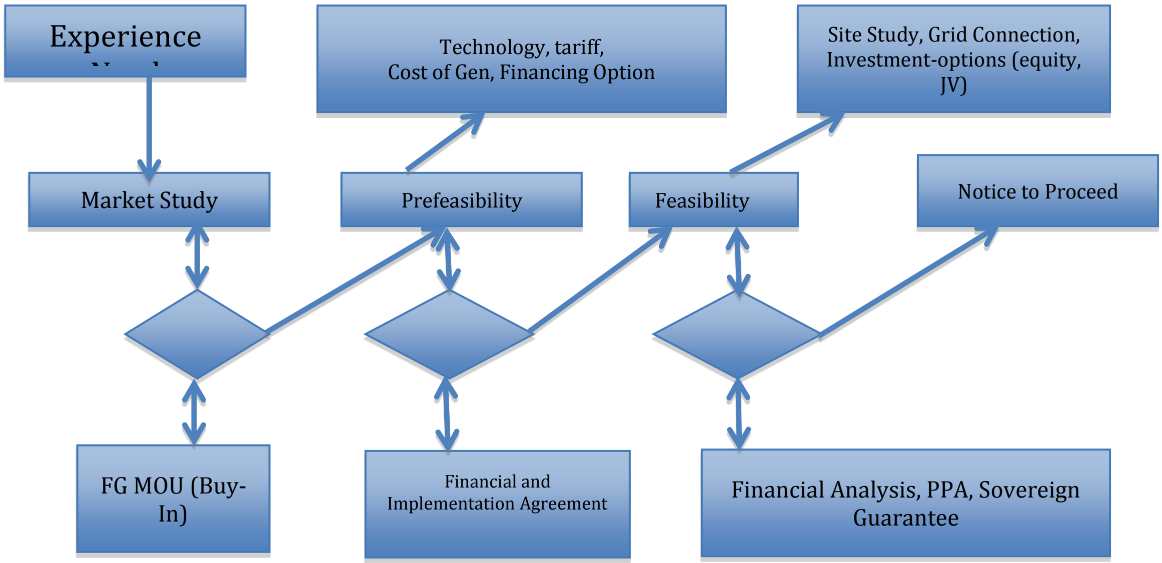
The gained experience in the allied electricity sector as shared by the respondent offered an insider view of the electricity need and inherent opportunity in line with local policy initiative. The respondent also indicated that developing solar required some backup energy solution and Nigeria had base-load energy of gas that acts as a backup in cases of shortfall. In addition the respondent also stated that since the tariffs were constantly been reviewed there seems to be a potential opportunity to be harnessed. As such in the respondents words it was an “Easy sell” if the cost of generation compared to other forms of generation was competitive in addition to revenue from tariffs as shown in (Appendix 1.1 and 1.0B).

5.6.5 Rationality (Decision-Making and Market Context)

The place of rationality in this case as described by the respondent is high for the Parent company as shown in (Appendix 1.1A). Although company E expressed her agnostic technology preference, development of solar over wind in the part of the country where both resources are available was due to technology maturity matched against resource availability. To that extent, the choice of solution was based on a set of criteria that made sense to project funders. In addition, the respondent used the word “Comfort” to describe intuition applied in the decision making process, which effectively indicates condition for progression on decisions. This was purely due to the limited information, lack of clarity and formalization in the negotiation process with the stakeholders as shown in (Appendix 1.1B). As compared to Company E’s operation in Uganda, the respondent experienced a more superior procurement system although the market is classified as emerging (refer to Appendix 1.1A). The respondent indicated that the confidence to operate in the market regardless of the potential uncertainty and risk was hinged on its close to a decade worth of local experience with the stakeholders in the power sector.

The respondent described the formal process leading to financial close in the Nigerian case. It is outlined in Figure 5.5 below.

FIGURE 5.5 Project Process Diagram for Company E



Source: Company E interviews

While the above is on-going extensive engagement with the stakeholders is continuous.

The respondent used the word "true-test" as a representation of some level of confidence, which is achieved during the feasibility stage. In this stage it was identified that resource availability, financial and economic parameters form the criteria of relevance. In particular, the respondent indicated that field resource assessment, equity security and Power Purchase Agreement make up the intended outcomes of this stage as shown in Appendix 1.1A.

The respondent stated also that this was achieved using both internal competencies and participation of industry stakeholder, so it was a combination of both internal and external actors. The respondent indicated that the findings of the different stages were useful internally however the measure of the viability of the project was only established when fixed assets such as land and permits were secured.

In essence, risk quantification from the different stages within the process was more of a theoretical concept especially with respect to influencing the decision-making process. Therefore intuition and experience form the tools required for the decision making in this case.

5.6.6 Viability Assessment (Market Context)

The respondent supported the viability assessment representation, but the question was asked as to why it was important to distinguish the themes. It was explained that it introduces another level of priority listing that captures the impact of market development in the decision making process. The two questions addressed by the assessment matrix were, priority of viability themes and stage of development across the various indicators. In terms of the viability dimensions and indicators, the respondent identified 17 fit indicators while 3 indicators each were matched to function, none with the flexibility theme.

TABLE 5.6 Data Representations for Company E

Frame of Reference	Observation	Extracts from Interview
Stimuli	Opportunity	"Renewable Energy mandate, need for power"
Decision Making	Logical and Intuitive	"True test, comfort" "First sight of relief when we secure land and obtain a permit"
Viability	Staged, Progressive but dependent on experience and facts	"Easy call when compared to existing cost of generation"
Stage of Market Development	Initial Market Mature Technology	"First Renewable Project in Nigeria"
Risk and Sustainability	Technical, Construction Risk	
Viability Framework	17 fit indicators 3 function indicators	

5.7 Summary

In this chapter, 5 company cases addressing DMP as applied to RE projects in their operational environments were covered. The Nigerian cases covered 3 unique solar projects while the 2 UK cases were generalised representation of projects handled by the firm. The focus of the chapter was to explore the market context, driver and stimuli, rationality and viability assessment ideas as it relates to decision making in the cases considered.

The market context as captured for the Nigerian cases, all described the market as being in its initial stage of development. This was associated with weak institutional framework and the lack of infrastructure as noticed in responses and supported by existing literature (Aliyu et al, 2015; Elum and Momodu 2017). Besides these issues, there was also the issue of gap in competency and dependency on foreign technology. Markets in their formative stages are mostly characterised by the emergence of new technologies attempting to diffuse into an existing system. This is similar to the representation as offered by Dewald and Trutter (2012) where market stages were classified into the nurturing, bridging and mass-market stages and that developed in this research. The nurturing or the initial stage is typified by market formation and emergence of new technologies. In the Nigerian case however, the initial stage displayed features of market formation and the use of mature but untested technologies in the locality of interest.

For the UK cases, the market had evolved with the progressive technology improvement, with respondents associating their markets of operation to the mature market. However, there was a sense of stagnation since the expected change in cost of implementing expected on these projects was yet to be achieved in the UK. It was mentioned by respondents that policies facilitated the diffusion of technological innovation and market formation; respondents in both countries shared their policy experience. Renewable Obligation (RO), Contract for Difference (CFD) and Power Purchase Agreements (PPA) were mentioned. The RO and CFD were shared as policies that apply in the UK market, these polices are different in their nature of function with the RO ended for all new generation and CFD been the currently available option for large-scale renewables. This in itself marks as sense in transition of the market as the progression from RO to CFD signifies the movement towards a more competitive market system. In the Nigerian case, the PPA's as applied in the Nigeria offers the developer guaranteed return on investment as compared to CFD's, which is only obtained after competitive biddings. This points again to the difference in stages of market development across both countries.

In terms of drivers for developing RE, the UK has a mandate to meet its carbon emission target. One of the approaches adopted is by promoting the transition to low carbon economy that translated into the obligation on electricity suppliers in the UK to supply a portion of their energy from clean sources. The two UK cases had to comply with this development mandates, therefore investing and developing RE as the logical option. The availability of support as well as resource was also considered as drivers. In the case of the Nigerian firms, there was an opportunity to meet an obvious electricity need, facilitated by the availability of resource and support that guaranteed return on investment. So there was both ethical and economic incentive to develop RE.

Finally as it relates to the DMP, the nature of the market in these cases is noticed to have considerable influence on the way decisions are made. The Nigerian cases complained about bureaucratic challenges even with the existence of clear regulatory guidelines. They all acknowledged the existence and use of standard processes. However these processes are only as procedural as the information available, hence promoting the use of intuition.

The UK participant on the other hand shared process that were standardised while relying more on facts as were available and value which is representative of the company's ethos.

In verifying the viability framework and prioritization of indicators, only 4 respondents engaged with the framework with most indicators associated to the fit theme, which clearly indicates strategic intent regardless of market stage of development.

These early findings indicate that policy change and transition is expected to lead to the transition in markets. However these transitions are in most cases plagued with uncertainty. Policy change does not translate to a sharp change in market, although that is the expectation. In terms of markets and their associated technologies, market maturity should be a signal to the potential state of technology but in some cases markets may be slow to adopting already mature technology. Also markets are developed to be accommodating to different classes of technology. Finally, the DMP is affected by market context and indirectly the stage of market development, which is mainly characterised by the state of policy.

CHAPTER 6 DATA ANALYSIS

6.1 Introduction

In this chapter, the behavioural and procedural elements are analysed across the five (5) renewable energy developers as it relates to the decision-making process applied to projects within their various market contexts. In addition, the viability assessment framework is applied across cases, which points to the firm's development strategy. Nevertheless, it is appropriate to highlights the two out of the three research questions addressed within the analysis:

Questions

1. What is the relationship between risk and sustainability from developer's perspective?
2. How does the transition affect the market and process of decision-making?
    a. Market Development Context impact on decision-making process.
    b. Market Development Context impact on viability assessment approach adopted by organisations.

The above questions and propositions are founded on the idea that the diffusion of new solutions, as is the case of renewables solutions requires a clear understanding of its overall system of application. This includes a clear understanding of the technologies, the market it serves and the institution that foster its rapid adoption. The market is a combination of institutions and market actors whose interests have to be collectively understood in other to fast track development.

The attempt at understanding the interests of actors representing firms and how they pursue their developmental interests within the RE development space led to the questions raised earlier. These questions point to the inherent challenges associated with development of RES, particularly to development as captured within different market contexts. Considering that development of renewable energy solutions occurs in both developed and developing countries having arguably different market orientations, different stages of market development and having different risk concern. One could assume that these differences could influence decision-making behaviour. The market context is expected to compel decision-makers to reconsider their modes of DM and assessment approaches.

Only recently has there been interest in the behavioural dimension involving decision makers within the development and investment sphere of renewables. (Wüstenhagen and Menichetti 2012) work significantly contributed to the market transition and context idea as applied within this research. The notion of market transition and context raises the questions of appropriateness of the rational decision-making approach as discussed in Chapter 3 across the different developer segments. The second question and its accompanying propositions are founded on this premise. Therefore, obtaining answers requires the fining down of the research goal, which led to, the definition of the lens and unit for analysis, which is the decision-making process (DMP) as applied to RE projects by the firm.

6.2 DATA SUMMARY

As was stated in Chapter 5 the main elements of data collection have been itemized into these four broad categories, which are

1. Developer Interest
2. Market Description
3. Decision-making Process Description and Rationality
4. Viability Assessment Matrix Response

Table 6.1 below presents data summary for the case study of projects from the developers considered.

TABLE 6.1 Data Summary

Company	**Developer Interest**	**Market Description**	**DMP and Rationality**	**VAM / Prefeasibility**
Company A	Opportunity Market need Mature Market Project Perspective Own Project	Initial Market Abrupt Policy Change and Bureaucracy New Technology Competency Gap Market Support exists	Process Exists Rationality shaped by internal and external involvement.	Fit (21) Function (10) Flexibility (1)
Company B	Opportunity Portfolio Expansion Own Project Mature Market	Mature Market Policy exists Technology Mature Support exists	Process Exists Rationality shaped by internal and external involvement.	Fit (16) Function (7) Flexibility (0)
Company C	Opportunity Portfolio Expansion Own Project Joint project Mature Market	Mature Market Policy exists Technology Mature Support exists	Process Exists Rationality shaped by internal and external involvement.	

TABLE 6.1 Data Summary (CONT.)

Company	Developer Interest	Market Description	DMP and Rationality	VAM / Prefeasibility
Company D	Opportunity Market need Own Project Mature market	Emerging Market Abrupt Policy Change and Bureaucracy New Technology Competency Gap Market Support exists	Entrepreneur point of view Process Exists Rationality shaped by internal and external involvement.	Fit (15) Function (7) Flexibility (0)
Company E	Opportunity Market need Emerging Market Project Perspective Own Project Joint project	Initial Market Market Support exists Abrupt Processes	Internal Process Exists Rationality shaped by internal and external involvement.	Fit (17) Function (3) Flexibility (0

6.2 MARKET DESCRIPTION AND PROCESS DEFINITION

Building on the notion that the different company cases considered take place in different market states, the market development context becomes the framework through which the review of decision-making process and viability assessment is to be analysed. This dimension is important considering the need for developers to understand the unique success requirement associated with each market context. In addition, it was vital to see where companies and developers place their development activities and if there was purposive transition across different stages from initial to mature. The reasons for considering this approach was to observe if these stages of market development as described in literature were noticeable in the accounts as shared by the companies in renewable energy development space. Furthermore, it was imperative to see how these transitions and context representations if noticeable, affected the process of decision-making and viability assessment. This extends the market context research areas into the renewable energy development and its application in developing countries.

As gathered from the exchanges, it is important to highlight that the companies/ developers considered, handled projects of 50MW and above therefore scale and size of project informs the basis for comparison. The market features as shown in the Table 6.2 below form the basis of market identification and comparison.

TABLE 6.2 Market stages of interest

Features	**Initial**	**Emerging**	**Mature**
Internal/External Process	Absence of process	Process in early development	Standardized Process
Financial Support	Grants	Subsidies, Power Agreements	Subsidies reaching End life
Technology	Untested	Tested and Proven	Commercialised
Strategy	Establishing Functional and Performance features	Growth and Expansion (Product Differentiation)	Cost Differentiation

Having the above features in mind that describe the market stages, state of technology, support and financial incentive and process were chosen to be the features of interest for characterising market transition and context. These three features are considered suitable since their relevance in the literature on development and diffusion of renewable energy development research (Shen et al. 2014) is prevalent and they are features that are externally noticeable and accessible. The Company case section below contains the data extracts from interviews and documentary analysis as it relates to implemented RE projects which addressed the outlined research questions as found in Section 1.3, detailed documents and extract tables are in the Appendix.

6.3 COMPANY CASES

6.3.1 Project Context for Company A

The case of interest concerns the 50MW solar project owned by Company A, an emerging indigenous Nigerian developer of renewables with its core interest in developing power generation infrastructure particularly solar. It was therefore important to consider the relevance of identified research questions within the context of this case. Addressing them in the order of interest as stated in the introduction, considering risk first in the course of the exchanges led to the development of the matrix displayed below in Table 6.3.

TABLE 6.3 Matrix for Risk and Risk Prioritization

Reported Market	Risk	Extracts from Interviews	Correction	Risk Prioritization
Initial Market	Market Risk	Market risk it's been there from day one, it's still there. Everything else that we are now trying to structure is effectively around market risks and the guarantees everybody seeks to make sense of".	Not Stated	1
	Political Risk	"There's Political Risk	Partial Risk Guarantees	2
	Technology Risk	"There's Technology Risk"	Use of EPC's with pre-existing experience	3

6.3.1.1 Risk and Sustainability analysis for Company A

The risks as displayed above have been ordered by the respondent perceived notion of importance with respect to the above stated project. As stated above, market risk is one that defines every other aspect of project development not just during the operational phase but also from conception of project. In the words of the respondent, “Market risk it’s been from day one its still there, everything else that we are now trying to structure is effectively around market risk and the guarantees everybody seeks to make sense of” (refer to Appendix 5.0J).

The statement above points to the relevance of market risk as it shaped all other decisions surrounding the project discussed. It is therefore understandable why a high premium is placed on correcting this risk and why it was considered to be the most pressing.

On the other hand, the consideration of political risk, which is linked to political instability or uncertainty, was related to the potential loss in lending attractiveness. In responding to the question about other risks captured asides market risk, the respondent stated,

“There’s Political risk, there is the technology risk largely. You know each one of them of course we are able to mitigate. Political Risk, that’s Sovereign and the way around that is the partial risk insurance which is critical to how lenders see the project” (refer to Appendix 5.0J).

Since power projects require vast amount of investment capital, some developers need to secure project finance. In some cases, these projects are internally funded while in others there was need for external project finance. For this case, project finance is required since the firm is in its infancy and therefore lacks the finances that other larger more established firms have. The justifications for projects especially in initial and emerging markets depend on how politically stable the climate for investment or development is considered to be (Keeley and Matsumoto, 2018). Africa and Asia are most prone to regime change, these political changes in most cases directly affect existing regulatory frameworks which may indirectly or directly affect the ability of a developer to execute an intended RE project. Since political risk directly affects the ability to finance projects and the bankability on support policy, decision makers keenly try to avoid markets that are plagued with potential regime change. Schwerhoff and Sy (2017) mentioned political risk as one of the issues facing the development of RE in Africa suggesting the adoption of multilateral investment guarantee agencies and private public partnerships as approaches that lower the risk concerns of private investors.

Furthermore, with power generation fundamentally requiring the use of technology, the identification of technology risk by the respondent, as one of the concerns was also plausible. From the statements of the respondent as shown in Appendix 5.0J, technology risk is largely associated to the lack of local solutions which translates to dependency on expatriate skill and knowledge.

Market risk is identified as the most pressing for two reasons, its ubiquitous and impacting nature. (Mitchell and Connor 2004) related market risk to the changing value of generation caused by changing market rules. (Menanteau, Finon and Lamy 2003) stated that market risk could be considered to be negligible in the presence of fixed support systems that guarantee safe revenue and price margins. Market risk is linked to the profitability and productivity of investment, in renewable development it is linked to delivering guaranteed generation and stable price support. This risk is mainly noticed in markets that are mature and driven by demand and supply pressures.

The respondent identified its market of operation as initial with respect to the market stage of development concept as shown in Table 6.2. However, the reported features of the market did not totally reflect initial market stage. Considering the risk prioritization and its link to market stage of development, it is expected that market risk should be negligible in an initial market stage. It was reported to be a concern in the respondent's market of operation. The initial market stage is characterised by the absence of a formal market system, one lacking tradable value and focused on performance optimization as suggested by (Utterback and Abernathy 1975). The respondent acknowledged the existence of market support mechanisms in the form of guaranteed power purchase agreements (PPA) which points to the existence of tradable value. These guarantees are not features of an initial market but are reported to exist in an initial market. They provide a hedge to secure long-term financial viability of projects (Menanteau, Finon and Lamy 2003).

The focus on market risk in this case is questionable for two reasons, first market risk should not be noticeable in the reported market context and secondly guarantees offered in the form of PPAs are meant to correct for any price uncertainties. In another account by the respondent, the question about the bankability of support was asked and the response was "There's only today one greenfield independent power project in Nigeria and so there is a bit of learning curve. This is the first time the country is at the bulk purchase level executing PPA's" (refer to Appendix 5.0C).

The source of market risk as captured by the above statement points to the executable nature of the offered guarantees. Hence, if the implementation of support is questionable, there arises the threat to financial viability and overall sustainability of the project as such the prioritization of market risk is understandable. Although market risk is quite significant so is political risk, this in most cases stems from change in regulation and support framework. The link between political risk and market risk is established through the impact of former on the latter; a politically polarised economy is likely to promote market uncertainties, which ultimately affects the profitability of any project not just renewable energy projects. This is further emphasised by the work of (Lee and

Zhong 2014) where it was stated that political uncertainty could easily change an economically sound project to an impractical one.

Finally, on the hierarchy of risks is technology risk, the respondent considered technology risk to be a product of the lack of experience with mature technology and the lack of local technology options. These concerns match the initial and emerging market representation as identified in Table 6.2. Furthermore, the respondent acknowledged that although there was an experience and competence gap, the technologies of interest were mature but yet to be implemented within the local development context. The work of (Liu and Zeng 2017) mentioned that technology risk emerges from disparity in technology maturity and market evolution. Maturity is captured by reliability and acceptability, the project developer goes for established technologies, which are yet to be locally proven, however this is the case as noticed in most developing countries since there is dependency on foreign technology solutions.

Having identified these risks, the respondent mentioned a few mitigation strategies adopted in the course of the project, which include obtaining sovereign insurance and deploying first class of equipment. These are considered as measures towards securing the economic viability and functional sustainability of the project as shown in Appendix 5.0J and 5.0H.

6.3.1.2 Market Transition, Context and decision making process analysis for Company A

Market categorization, decision-making and viability assessment forms the second part of this discussion. The representation as shown in Table 6.4 depicts the market representation and the allied concepts

TABLE 6.4 Matrix for Market transition and process definition

Market Stage	Market Transition	Process	Support	Technology	DMP	DMP Actors	Viability
Initial	None	Exist	Exist	Established but not locally tested	Exists	Internal External	Fit (21) Function (10) Fit (4 Priority) Function (1 Priority)

In addressing the issue of market transition, context and its impact on the process and viability, the Table 6.4 above captures the responses for company A.

Having characterised the renewable energy market with respect to support, technology and process with the underlining assumption that transition is signalled by these elements changing. The responses point to a market showing features of the initial and emerging market. The market definition as used within this research is an economic and social representation involving actors that exchange goods and service driven by forces of demand and supply but also shaped by institutions and its rules (Kaplow, 2015; O'Shaughnessy et al. 2018).

The respondent classified its current market of operation as being in its initial stage, the respondent stated,

"We are in the first stage" (refer to Appendix 5.0D).

However in terms of where it ideally seeks to operate, the respondent stated, “We are in the market where technical feasibility and economic viability is established but of course charity begins at home right” (refer to Appendix 5.0B).

The above statement indicates that although the interest of the firm is to develop in markets that offer some certainty in economic viability, its current development attempt is in a market it classifies as been in its initial stage of development. The choice to develop this project knowing that the financial could be challenging raises a question to the motive for the choice. Since profit maximization through the correction of transaction cost forms the basis for the existence of firms, this case contradicts that idea. Three reasons are likely to explain the action to take up such investment, the need to establish a first mover advantage, the need to be socially responsible and finally the reaction to regulatory requirement to operate in the market.

Managers are the driving force behind organisations; these individuals have their interest and that of stakeholders to protect but the fact that self-interest drives decision-making has been established (Bosse and Phillips 2016). Therefore, a manager seeking to build a reputation of an innovator is more likely to take up development in such environment especially with the financial hedge provided. Furthermore, from the firm perspective, becoming the first or leader amongst peers could be a motivation for such a step. In the Nigerian case, the project is going ahead regardless of the uncertainty the market presents.

The need to meet corporate obligations is another reason that potentially could drive such a decision; an example was the initiation of clean development mechanism (CDM) projects. CDM is one of the approaches within the Kyoto Protocol that promotes the development of RE projects with the goal of generating certified emission reduction units that may be traded through emission trading schemes (Tang and Popp, 2016). However, this mainly was targeted polluting firms in developed countries and as such does not necessarily apply to the developing country case.

Furthermore, regulation by external stakeholders or the existence of national renewable energy production targets can also lead to the initiation of projects of this nature. The renewable energy development space is part of a larger electricity generation system as such external system effects such as new government policy or even stakeholder desire to improve corporate social responsibility image can trigger the initiation of projects of this nature regardless of the perceived risks. In terms of national mandates, Nigeria through the renewable energy master plan, projects to generate 2000MW of electricity by 2020 from renewable energy sources; this acts as a potential incentive to participate in the market (Oyedepo et al., 2018).

In terms of identifying the existence of transition, one can assume the absence of transition since the reported market stage is the initial market stage. In this stage, the support mechanism takes the form of grants, which are targeted at developing and verifying technologies and processes may lack structure and refinement.

In the case considered, the initial market position was reported but when the features of the market are considered alongside the market features as standardised in Table 6.2, the market shares striking similarities with the initial and emerging markets. Looking at the features of interest, the market offers financial support, which comes in the form of long-term PPA's. The Nigerian renewable energy market offers some financial certainty through the PPA's offered by the national bulk electricity trader. This offers a level of certainty in terms of return on investment of the private developer. In addition, the adopted technologies are classified as mature although not massively deployed locally and processes around implementation and approval exist but are not standardized. It shows a deviation from the reported initial market scenario. Furthermore, the market actors in an initial market are mainly research and development players designing and validating technology option. This case of an initial market has developers looking at exploiting market opportunities indicating the establishment of intrinsic value within the system, which conventionally, initial markets lack.

This is a case of leapfrogging as against transition; here the intermediary steps involved in the diffusion process and the resulting market formation are circumvented since these markets simply adopt developed technologies as against developing them using the technology innovation pathway (Amankwah-Amoahm, 2015).

Alluding to the point made earlier about managers and decisions, information obtained from the exchanges show that although the company classifies itself as operating in an initial market, it does have standard external and internal processes. One of the propositions was that market context should impact on the nature of decision making process. The idea was that in the initial stage of development, organisations were not only poorly organised but also lacked standardised decision processes especially since the criteria for which decision depended upon were ill-formed or non-existent. In the case considered, although the market is reported as initial, there appears to be coherence in process both internally and externally which is also evidence of deviation from the initial market as such challenges the assumed assertions as found in Table 6.2. Consequently, with the existence of a process particularly an internal DMP as utilised by the firm at the reported initial stage, it is plausible to argue that the process will get more refined as it progresses which is supported by the notion of learning by doing. The work by Lamb, Becker and Nunes (2018) show the adoption of incremental learning in the execution of mergers and acquisitions, which presents a scenario of firms adapting their decision making processes to the environment within which they operate. The decision-making process in the reported market context is expected to progressively improve as mentioned earlier with the availability of information and improved procedures. Hence, rationality is likely to improve as the market maturity builds.

In summary, the case showed more features of emerging than the reported initial state of market development. The above representation does not point to the existence of market transition since there never was any a 'prior market experience. Rather, it is a case of leapfrogging, which occurs when developing systems adapt approaches from developed systems without necessarily going through their cycles of development.

The second proposition was on market context and influence on viability assessment. In the absence of noticeable transition, the responses of indicator association to the viability themes as applied to the current state are reported. The respondent associated 21 indicators to the fit theme, 10 indicators to the function theme with 1 indicator assigned to the flexibility theme. The responses show that 80.7% of the indicators were associated to the fit theme representing the overall strategic intent of the firm, 38.4% of the indicators were associated with operational requirement representing the functional theme. 26.9% of the indicators were shared between fit and functional theme.

The matrix shows that economic, social and technology based indicators are captured within the fit theme however only economic and technology indicators were associated to the functional theme. The themes as stated in Chapter 3 represent the overall areas of interest every firm developing renewables must meet to be viable. Therefore the identification of indicators that satisfy these interests is the first step to establishing viability, secondly the emphasis on particular indicators point to the strategic intent of the firm.

The responses show the way potential decision-making indicators are categorised from the organisations perspective. From the understanding of strategic intent as shared by (Utterback and Abernathy 1975), the initial market developer should place emphasis on performance while cost reduction or profit making will be the interest in mature or emerging stages.

This reported market state is expected to focus on technology-based indicators since performance is the focus. On the contrary, technology, economic and social indicators were associated with the fit and function theme. Modularity was associated to the flexibility theme. The focus of this initial market developer was not just establishing the efficacy of the solution with the association of technology maturity to the fit and function theme but also on making profit. In this case the firm makes adjustments as shown in its indicator association to suite the market condition. Since the market offered the opportunity to make profit, there was emphasis on securing economic return with indicators such as Return on investment, Net Present Cost and Internal Rate of Return associated with the fit theme. McCarthy, Collard and Johnson (2017) addressed the organisations need to adapt as they operate within adverse environments, stating that reconfiguration is essential of firms to be continuously competitive in their operating environments. The resilience of a company is associated with its ability to make changes to its value configuration as noticed in this case. Although the value in terms of economic guarantee is seen as uncertain, the firm sees the munificence in the PPA's offered as enough incentive to develop in this market.

Finally, in addressing the question of indicator prioritisation in the prefeasibility or diagnostic stage as mentioned in Chapter 3, the respondent identified 11 indicators as most relevant to its decision in this stage. These indicators are access to finance, policy attractiveness, modularity, resource availability, land availability, tariff sustainability, investment cost, return on investment, technology maturity, competence and grid availability. These indicators were matched to the viability matrix, of the 11 indicators selected, 10 of them fall into the fit theme while 3 are functional, in addition 10 of the indicators were considered high priority indicators for the prefeasibility stage of development. 4 indicators were unique to fit and 1 was unique to function. There is an obvious prioritization toward achieving fit within the overall viability framework with both the viability themes and indicator prioritization.

6.3.2 Project Context for Company B

The next case of interest is one of the leading developers of renewables in the United Kingdom with developing power generation infrastructure making up its core interest. Company B has development projects primarily in the United Kingdom in the areas of onshore and offshore wind. The continuously changing landscape of development makes it imperative to consider the research questions within the context of this case. This case was a generalised project perspective since this company has a large portfolio of projects. The question on risk, sustainability and viability is addressed using the matrix displayed below in Table 6.5 was developed

TABLE 6.5 Matrix for Risk and Risk Prioritization

Market	Risk	Extracts	Correction	Risk Prioritization
Mature Market	Policy and Regulatory Risk		Not Stated	1
	Technology Risk	“This is present with innovation in technology”	“to drive the best possible deals from our suppliers so yes we are able to get good deals from both turbine supplies and construction companies that we utilize	2
	Market Risk	“With the withdrawal of the subsidy arrangement it has become more complicated”	Developing corporate PPA	3

6.3.2.1 Risk and Sustainability analysis for Company B

The development of renewable energy projects requires substantial capital investment and therefore funding is critical, so is achieving an electricity price to attract a willing off-taker, meeting these conditions puts the development of interest in good stead for the regulators and developers. Company B is unique because it does not require external funding and does not sell its generated electricity in the open market. It is not dependent on external financing since its projects are internally funded by its parent company. The respondent stated, “We don’t have to spend time going out to the electricity market to trade our power” as shown in Appendix 2.3B and 2.2B.

There is some established advantage and certainty in having the parent company as the off taker. Although the above scenario portrays a level of certainty, there are still attendant risks involved in the development process. In terms of risks, the company report and responses to the questions on strategic constraints and requirement points to these three (3), Policy and Regulatory risk, Technology risk and Market risk as shown in Appendix 2.2C, 2.2D.

Taking this from the standpoint that these development projects are been carried out in developed markets and countries, the influence of regulation plays a significant role in any development, particularly RE development. The UK RE development sectors is a highly regulated environment, which focuses on people participation, environmental protection, policy compliance and planning permission. Notwithstanding, a company interest and capacity to develop, it is restricted by national and sometimes local regulatory guidelines established to address these regulatory guidelines. In addition, a huge part of securing approval on projects is public acceptance, since these developments become integral parts of communities. These exogenous factors shape the DMP and also radically affect the timelines of projects. One of such cases as observed in the UK and in other parts of the world is the issue of land use and visual impact especially for onshore wind. This culminates into the Not-in-my-Backyard (NIMBY) argument, which ensues between potential developers and project hosts. These issues can be addressed through the passage of regulation that aids the land search and permissions process. Since, the utility companies in the UK are obligated to develop a significant amount of electricity from renewable energy sources.

Company B as a subsidiary of a major utility company has a duty to introduce a significant amount of renewable into the overall company portfolio as such these development projects meet these regulatory obligation as shown in Appendix 2.2A and 2.2B. This policy requirement and their attendant support schemes are changing and thereby introducing uncertainty and risk as shown in Appendix 2.2D.

Company B takes a rather interesting position when it comes to technology and technology adoption, it has a flexible approach to the adoption of technologies as shown in Appendix 2.2C. However, with respect to its onshore and offshore operations it mainly relies on established technology solutions. This leads on to the next risk of interest, the technology risk. The respondent links this to its generation capability and other ancillary technology requirements particularly the grid availability as shown in Appendix 2.3G. Since generation makes up the core deliverable for Company B, there is prime interest in acquiring technology solutions that will deliver optimal value for money and inline with that the respondent stated,

“That’s something that affects our overall performance as a business so we take on what are the best equipment for what we are doing” (refer to Appendix 2.3K).

Generation is just one part of the entire process of development, the inability to secure the onward transfer of generated electricity makes the development process futile as such grid availability impacts significantly on the decision to take up any form of development.

Finally, the last risk associated with this case is market risk, which is tied to the firm’s ability to secure a steady line of revenue. This is conventionally one of the top ranking risk concerns within the hierarchy of risks (Liu and Zeng, 2017) but in this case, it is not as emphasised as the first two when the strategic requirements were discussed. This could be attributed to the nature of the company's business as stated earlier. It does not consider market risk a pressing priority but in the grand scale the ability of the parent company to secure revenue ensures the progressive expansion of its portfolio as shown in Appendix 2.2D. Market risk is fundamentally underpinned on the ability to secure revenue through guaranteed long-term subsidies and manage transaction cost (Newbery, 2017). Company B takes a different look at revenue generation with interest in developing projects subsidy free. This position is reiterated by the respondents' statement,

"It's a case of taking our wind farm project and looking at one case where they can be evolved to be financially viability without price support" (as shown in Appendix 2.3B).

This notion of developing models of securing revenue without price support suggests that a conscious effort to correct market risk is part of the firm's strategy. In countries like Germany and Brazil, photovoltaic and bioethanol respectively have evolved to the point where they are developed without they need of market support (Bell and Zilberman, 2016). The same cannot be said for the UK as the diffusion of wind and photovoltaic has not gotten to market saturation.

In terms of risk prioritization, regulatory risk is considered as the most important followed by the technology and finally market risk. This is non-conforming since most firms in the mature or emerging market have market risk as the most important but as stated earlier, the existence of a secure line of funding serves as a hedge against the risk. A relatively stable development market where cost of production is predictable and the existence of an established off-taker of power allows for Company B to prioritize on her main goal, which is to generate clean energy. The sustainability and viability of Company B is fundamentally pinned on its ability to generate power for its parent company therefore the regulatory restriction and policy alterations are the most impactful factors to its operations since significant competence has been gained from project implementation globally as shown in Appendix 2.2A. In the grand scheme of things, the ability to trade the generated power at a market rate that is considered profitable has to be achieved.

Finally looking at the risk prioritization in line with the reported market of operation, it is plausible to see that a mature market will have standardised regulatory systems as such compliance by operating companies is a priority. On the other hand, a mature market is less exposed to market uncertainties associated with changing support schemes as such present lower market risks to developers, which matches the representation shown by the case as a subset of its parent company.

6.3.2.2 Market Transition, Context and decision making process analysis for Company B

Market categorization, decision-making and viability assessment forms the second part of this discussion. The market representation and associated concepts as it relates to company B project approach is shown in Table 6.6 below.

TABLE 6.6 Matrix for Market categorisation and process definition

Market Stage	Market Transition	Process	Support	Technology	DMP	DMP Actors	Viability
Mature	Mature to Emerging	Exist	Exist	Established	Exists	Internal External	Fit (16) Function (7) Fit (7 priority elements) Function (3 priority elements)

In addressing the issue of market transition, context and impact on the process and viability, the Table 6.6 above captures the responses for company B as regarding their place in the market and process definition. In addressing the issue of market context, the respondent didn't explicitly classify its current market of operation as being in the mature stage but this was implied from the description of its onshore and offshore operation.

When asked about where the respondent places its market of operation, the respondent stated,

"We are clearly in the mature stage for the majority of our activities" (refer to Appendix 2.3B).

The above statement indicates that maturity is associated with a segment of its operations, this point to the existence of segments that are either in other stages of development as corroborated in the report where offshore was classified a less-mature as shown in Appendix 2.2B.

The type of support currently applied was also used as a predictor of the market state. The respondent mentioned that most projects were on the renewable obligation (RO) while moving towards the contract for difference (CFD) support mechanism, which is more competitive indicating motion towards a mature market representation. The UK market currently has transitioned into the CFD support scheme, which introduces a more competitive market driven system, in some sense this points to the maturing of the market.

Although the reported market position is mature, when it is considered along side features as standardised in Table 6.2, the market shares striking similarities with the emerging and mature market. The market still offers financial support, previously the RO and now the CFD. The use of market support in the sense as applied is a feature of emerging market, as it offers developers guaranteed financial returns. On the other hand, forces of demand and supply drive a mature market in the conventional sense.

Furthermore, the adopted technologies in this case are mature with commercially proven credentials. Processes leading to project approval and implementation are formalized, indicating its mature nature as shown in Appendix 2.0, 2.1 and 2.2A. Back to the point on the market of interest, the response clearly indicates that Company B is in a market that guarantees certainty in return achieved through the implementation of support. However, it should be mentioned that there is a conscious effort to move from subsidy dependency to a purely price driven system which is a reflection of a classical mature market.

The unique position of Company B as a generation company with a parent company automatically places its actions under the control of the parent body, which is a profit driven entity. Although Company B is open to trying solutions that are rather new; the choice of what to develop is defined on the validation as established by the parent company. Therefore, this firm targets markets that offer certainty since profit driven companies seek out mature markets. The ability of the parent company to make profit ensures the continuous development and sustainability of Company B as such profit maximization argument for the theory of the firm is validated.

On the issue of transition and its effect, it has been highlighted that continuous change in regulatory framework has led to change in the state of support, which is linked to potential uncertainty with revenue stream. These changes according to the respondent indicated that there is a movement within the market from mature back to emerging, the respondent stated,

"I suppose what was a mature market has deteriorated almost to an emerging market, it has gone through a life cycle really" (refer to Appendix 2.3L).

This is rather ironical since the newly introduced support scheme is meant to gradually move the market towards maturity. The notion that it rather deteriorates the market has compelled the organisation to reconsider its overall strategy and decision-making process structure.

In terms of overall strategy, the respondent indicated that although the disruption caused by the change has potential effect on revenue. It has commenced exploring alternative opportunities, one of which is establishing PPA contracts with private establishment who are willing to pay a premium for clean energy, as shown in Appendix 2.3L. In terms of process change, the respondent indicated that there was need for adjustment in process not in its procedural approach but in the area of analytics, shown in Appendix 2.3F. The respondent stated, "There has always been a gated process based on this but yes it has been modified and you know in particular with the withdrawal of the subsidy arrangement it has become more complicated and a tighter process because of the need to display that the project if constructed will generate at a level" (refer to Appendix 2.3G).

In essence, more constraints have to be introduced in other to make economic sense of the developments of interest. Although there is a backward transition as mentioned in the case for Company B, the effect on process involves employing increasing logic to facilitate the process of decision-making. Several papers Mintzberg, Raisinghani and Theoret (1976) and Elbanna (2006) have reported the presence of logical incrementalism, which is a decision-making approach anchored on the idea that in the absence of full information, decisions are progressively adjusted to fit the changing requirements of the decision-making environment. The decision-making behaviour as highlighted in this case totally replicates that assumption; it does not change the procedural nature of the decision process, as shown in Appendix 2.1. Rather it improves the process by introducing newer logical requirements.

In addressing the effect of market context and transition on viability assessment, viability as considered in this research points to the ability of the firm to meet its key interest of fit, function and flexibility. The responses to the viability matrix as applied to the current market state are reported, the respondent associated 16 indicators to the fit theme while 7 indicators were associated with the function theme, with no indicator associated with the flexibility theme. The responses show that 61.5% of the indicators were associated with meeting organisational strategic goals and requirements, 26.9% of the indicators were associated with operational requirement. 3 indicators are associated with both fit and functional theme amounting to 11.5%. The responses show a combination of economic, social and technical indicators for the fit theme, with economic and technology indicators making up the functional theme. These indicators represent the elements that must be considered, if the project of interest is to be termed as viable at the current market stage of development.

Looking at the association of indicators, the need to secure financial return and correct cost forms the strategic direction of the firm. The work of Sardana, Terziovski and Gupta (2016) looked at the need to establish strategic alignment as businesses respond to market changes. The state of the market, signals the need for firm to secure value through product delivery and sustainability, therefore focus on return on investment while ensuring that environmental concerns are addressed represents the overall strategic position of the firm.

Finally, in addressing the question of indicator prioritisation in the prefeasibility stage, the respondent associated 17 indicators to this stage however 8 are considered top priority. These indicators are policy attractiveness, investment cost, Resource availability, land availability, tariff sustainability, technology maturity, competence and grid availability. Seven (7) of the identified indicators are associated with the fit theme while three (3) are associated with function. There is an obvious prioritization toward achieving fit within the overall viability framework with both the viability themes and indicator prioritization.

6.3.3 Project Perspective of Company C

Company C is a leader in the development of renewables in the United Kingdom with founding interests in the hydropower development and currently on onshore and offshore wind development. The interest in the onshore and offshore development has facilitated the development of over 50 RE projects with the acquisition of companies with expertise in this area of development interest. The perspective presented in this case was a more generalized representation, however specifics were drawn with respect to unique project scenarios. In addressing the questions of risk and its link to sustainability as it relates to projects, Company C has taken both a project and portfolio styled approach in tackling the issue of risk using its internally developed risk management framework which points to standardisation. This ultimately puts the firm in a position to effectively deliver its mandate not just to shareholders but also to its electricity customers. Table 6.7 below shows the risk representation as shared by the respondents.

TABLE 6.7 Matrix for Risk and Risk Prioritization

Market	**Risk**	**Extracts**	**Correction**	**Risk Prioritization**
Mature Market	Market Risk	"we are kind off at the mercy of the government regime we operate within, so an incentive such as the RO has a long-term impact on defining what we can or we cannot do"	Long-term Support such as the RO and CFD	1
	Technology Risk	"we don't engage in trying left field technology"	Tried and Tested, Experience Tender Process	2
	Construction	"so we will consider thing like construction period as basis for decision-making, an offshore project of say two years or four years, so the one of four years sound more riskier to build"	Experience Partners Tender Process	3

6.3.3.1 Risk and Sustainability analysis for Company C

The risk perspective as shared by the respondents of company C reflects the project and portfolio dimension. This is linked to the nature of Company C's operations; the respondents described Company C as vertically integrated meaning that it has business interests that were diverse and interconnected, as shown in Appendix 3.2A. It has businesses in the distribution, generation and supply of electricity, therefore success or failures in any sector has a ripple effect on the other. The documentary analysis of the firm's annual report for 2018, 2017 and 2016 confirm the existence of a project and portfolio perspective for risk consideration. The above stated perspective facilitates the effective delivery of overall organizational goal. This involves the firm adopting an internalized risk management framework, used for risk assessment at the company portfolio level as captured within the reports as shown in Appendix 3.1B. The risk perspective as described within the ethos of the firm focuses on safety as the main deliverable, making it the firm's a highest priority.

On the project perspective, the respondents acknowledged the existence of three (3) project-based risks, construction, technology and market risk as shown in Appendix 3.2E. The earlier company cases share similarities however the introduction of construction risk is new, it is particularly linked to timelines for project delivery and how different project construction times are assessed within the decision making process. This is important since delays in projects may affect the effective supply of electricity to consumers. In addition, there was also technology risk; this from the respondent perspective had a direct link to technology maturity and potential energy generation interests. The respondent stated, “Was considered a slow mover however in retrospect the move to master its microcosm is now considered a shrewd move as competence and expertise has been gained in the long-term” (refer to Appendix 3.2C).

The statement indicates that understanding and mastering technologies is a priority, so far this has defined the direction of development as Company C has focused on just onshore and offshore project as compared to other contemporaries. The technology concern of Company C builds on the need for safety, effectiveness and efficiency, which are only derivable from the use of mature technology options.

The risk averseness towards technology classified as emerging as shown by the firm could led to loss in the opportunity to be pioneers in innovative technology within potential area of development. In the opinion of the respondents, this does not seem to be a problem as it was stated,

“We deliberately do not pioneer cutting edge option as such we do not engage in trying left field technologies” as shown in Appendix 3.2D.

This reveals an inherent aversion for risk when it comes to supporting solutions that are yet to be commercially proven. (Foxon et al. 2005) highlighted the need for systematic involvement of actors within the renewable sector to facilitate the diffusion of innovative solution, stating that diffusion of solutions depends on progressive adoption. Although the approach by Company C to focus on mainly tried and tested solutions can be seen as an inherent risk-averse attitude. Its viability agenda, which emphasizes on safety of technological solution, justifies its current approach as shown in Appendix 3.1B. The issue of the technology risk is further escalated by the presence of market risk as highlighted in the work of (Jacobsson and Lauber 2006, Foxon et al. 2005, Liu and Zeng 2017). Respondents identified market risk associated with the inability to predict revenue stream as critical in defining and establishing the interest to take up a project in the first place. This was linked to the overarching price support framework, which makes the development of renewables slightly competitive over the conventional generation options. A failure in the framework affects the defined or expected cash flows of the firm, which directly affects three of the group principal risk as shown in the sustainability report (financial liabilities, commodity and energy affordability), as shown in Appendix 3.1B.

The renewable market is set up to facilitate diffusion through the implementation of various types of support schemes matching varying technology development stages. However, there is no direct association between technology used in a market and the market's maturity. Although there is an expected trajectory for which technology and markets should take, where type of technology indicates the stage of market development. In the cases considered so far, maturity of technology does not necessarily imply maturity of market of operation, for that reason monetary and fiscal structures are still required.

In this case, although the respondent classifies their market of operation as mature, they acknowledge the need for these support structures to facilitate development and ensure revenue certainty. The highlighted risks are quite prevalent across the already mentioned cases. However, they do have varying impact on the sustainability and viability as considered within the various cases. The market risk is considered the most prevalent since its quantification shapes the prediction of financial performance, which is critical for Company C and as such, influences the decision to consider a project. Market risk is exogenous, primarily caused by the operating environment; therefore mitigation strategies are external facing.

On the part of technology risk, a two-pronged approach focused on effectively managing people and engineering projects is adopted. The focus on promoting safety and engineering excellence is considered a key value to be maintained by Company C as shown in Appendix 3.2D and 3.2F. The aforementioned represents the mitigation strategy for tackling construction risk.

6.2.3.2 Market Transition, Context and Decision Making Process analysis for Company C

From the previous section, Company C identifies its operations as situated in the mature market as shown in the Table 6.8 below.

TABLE 6.8 Matrix for Market categorisation and process definition

Market Stage	Market Transition	Process	Support	Technology	DMP	DMP Actors
Mature	Evolving	Standardized	Support Exists	Tried and Tested	Exist	Internal External

From the responses obtained, there was a clear interest in mature solutions as it relates to technologies; this is tied to the origin of its operations founded in hydropower generation, as shown in Appendix 3.1A and 3.2B. A similar pattern is noticed with Company C expansion into onshore wind, which has established technology solutions. Company C in the last decade has acquired companies in the areas targeted for intended expansion and these companies are considered mature in terms of the experience they have demonstrated in the fields of interest.

Although there is a general interest in mature solutions and markets, the respondent considered its offshore wind operation as a developing market, "Although the wind portfolio as currently covered captures offshore and onshore wind, offshore wind is considered to be a developing market" (refer to Appendix 3.2B).

There was a broad acknowledgement of development operations in the offshore and onshore market, with onshore operations classed as more developed. This could mean that onshore is considered to be mature while offshore is considered as less mature or developing as indicated by the respondent.

The notion of maturity here is linked to the number of projects which could be further associated with comfort established with the adopted technology solutions. This is reflective of the statement by the respondent "So Company C harnesses its experience and knowledge in areas of known competence" (refer to Appendix 3.2C).

Therefore, the broad reflection of the sector as developing could just be a representation of organisation's perspective with respect to its experience with offshore operations. This notion is further emphasised in the annual report 2018 where onshore development is identified as the core area of strength. Both interview extract and annual report refer to the market as fluid, this is related to the observed opening up of the market as shown in the level of participation in the generation business with noticeable expansion beyond the UK big 6 electricity providers. This fluid nature as described does not necessarily establish a definitive structure for the market, so the use of the market features as means to match market positions is practical. The features of market characterisation, as defined in Table 6.2 are adopted and the exchanges show that support is critical to the development of projects within the market, as shown in Appendix

3.2C. The respondents acknowledged the presence of Renewable Obligations and now Contract for Difference, which puts a more competitive tone to the development. In addition, the technologies utilized are considered to be mature but the market still requires support (Foxon et al. 2005).

The respondent made the point that although other countries within Europe are of the view that they could develop, onshore projects without price support that partly depended on their overall market structure. This distinction between the UK market and other markets within Europe points to the varying levels of maturity.

In terms of processes as utilized, they are standardized since the market is mostly regulated. In the case of Company C, procedural rationality appears to be high as shown with the existence of a risk framework, this is further strengthened with the descriptive decision making map shared by the respondent as shown in Appendix 3.2J. The respondent broke down the DMP to two main parts covering idea definition to concept refinement as stage one while concept refinement to final investment decision was stage two. The respondents also mentioned that having a standard set of procedures is expected for any FTSE 100 organization, which it prides itself as one.

The identified market features do not totally conform to those of the mature market, since the market still requires prices support. It does show features of emerging and mature market. In essence, the overall representation of the market has no direct effect on the internal procedures of the organisation. However the dependency that results from need of the organization to comply with regulation as posed by the operating environment has some effect on the adoption of standards within the process of decision-making.

In terms of viability assessment and transitioning, there is the acknowledgement of evolution in the market but as a business entity, the fundamental interest of the firm lies in mature markets. Consequently, the respondent indicated that viability is assessed on the basis of a business case that has to meet internally defined criteria. Therefore with the entry point been a market classified to be business ready, the model used for appraisal is as represented in the decision-making process. The knowledge of changing market conditions consequently introduces the need for revaluation of decision-making indicators. In essence the viability assessment is a core part of the decision making process but it is adjusted with changing market or environmental conditions.

Finally, in addressing the last question which had to do with criteria prioritization, the respondents had difficulties saying it was very subjective as such rating were not obtained, although the fit, function and flexibility representation representing the overall viability framework was considered to be representative.

6.3.4 Project Perspective and Company D

Company D is a renewable development company in Nigeria, one among the 14 independent power-producing companies as recognized by the Nigerian Bulk Electricity Trader (NBET). Its core interest is development of both onshore wind and solar projects in the sub-Saharan region with particular interest in Nigeria. It currently handles a 50MW solar project in Northern Nigeria. In addressing the first question about risk and sustainability, the Table 6.9 below shows the risks identified by respondents.

TABLE 6.9 Matrix for Risk and Risk Prioritization

Market	Risk	Extracts	Correction	Risk Prioritization
Mature Market	Market Risk			1
	Technology Risk		Tried and Tested Experience Partners Tender Process	2
	Construction		Experience Partners Tender Process	3

6.3.4.1 Risk and Sustainability analysis for Company D

The respondent identified and prioritised the risks as shown in Table 6.9. The construction, market and technology risks are linked to the efficient delivery of the RE project and its long-term sustenance. The first and most pressing as indicated by the respondent was the market risk, its relevance stems from its link with price support and revenue generation. Electricity as a commodity requires the existence of supply and demand channel for it to be considered a marketable good. The respondent considered the existence of the need for energy as an indicator of the existence of an opportunity. However, the absence of a willing buyer and seller structure points to the absence of a market and potential existence of market risk as shown in Appendix 4.0E. In the case of Nigeria as stated by the respondent,

"We are grossly underserved in terms of electricity bottom line the market exist", as shown in Appendix 4.0A and 4.0B.

Although the need for energy is established, the market is not fully formed since there are quite significant structural and institutional flaws as shared by the respondent.

“In Nigeria there has been policy somersault at every point in time plenty, I have experienced it. I tell you if not because I am a national patriot like I am, and believe Nigerian problems must be solved I would have left the power sector”, as shown in Appendix 4.0A and 4.0B.

In correcting for these potential failings, the respondent acknowledged the provision of long-term government guarantees. It should be noted that market risk in its representation is present in most economic systems. However the form it takes in the RE market scenario where revenue generation is dependent on support indicates the market under consideration is far from mature. In the absence of a reliable market structure, the developer along with the regulator adopted a market risk mitigating option of introducing the PPA’s; this offers some level of certainty especially for the developer and potential financiers of the project. Considering that energy generation is the main deliverable, technology and infrastructure plays a significant role as such the inclusion of technology risk is plausible. The situation with this development case is one where Company D has this as its first renewable energy project, so experience with technology is totally non-existent as such knowledge is obtained from the EPC’s perspective. In addition, there is the lack of local supply chain that further exposes the developer to external dependency. However, the project developer’s approach to addressing the potential technology risk was identifying EPC’s with reputation of developing projects within the sub-region, which is considered a risk mitigating approach in addition to obtaining long-term contractual equipment guarantees offered on the power generating kit.

Finally, construction risk was mentioned as well by the respondent, this is linked to technology risk especially if the technology provider also acts as the project developer. The failure of the project developer to procure first class technology solution translates to delays in the execution of the project. However, this is not the case for Company D, since a third party construction company has the singular duty of building and operating the facility while procurement of generating solutions is handled by a different company. It is logical for this to be considered a risk of higher significance if construction and technology delivery are facilitated by the same entity. However, in the case as considered the emphasis was on technology since this was the main source of value further exacerbated by the absence of local evidence surrounding technology at the scale implemented. There was a greater uncertainty around the technology as compared to the medium and structures for its delivery.

Looking at the above risk categories and mitigation strategies, market risk is considered the most pressing as noticed in previously considered cases. Considering the Nigerian market scenario as lacking in both experience with technology and policy, it will be plausible to consider technological risk as the most important. This was not the case since technology maturity is visible across geographies as such the respondents placed lower emphasis on this risk. This level of confidence established on technology as shown by the respondent, makes it logical to focus on securing revenue. The next section addresses the market stage profile for the case considered and its potential effect on decision making process, viability assessment and indicator prioritization.

6.3.4.2 Market Transition, Context and Decision Making Process analysis for Company D

This section addresses the market transition, context argument in the case of Company D, Table 6.10 below presents the findings as shared by the respondent.

TABLE 6.10 Matrix for Market categorisation and process definition

Market Stage	Market Transition	Process	Support	Technology	DMP	DMP Actors	Viability
Mature	None	Exist	Exist	Tried and Tested but not locally	Exists	Internal External	Fit (15) Function (7) Fit (5 priority elements) Function (1 priority elements)

In addressing the first question about transition in the market, the respondent's experience of the market change can be associated with the fluctuation in policy experience and the corresponding bureaucratic bottlenecks. This perspective of the market is one that is retrogressive as it disrupts developer interest.

On the issue of market context, using the features as developed in Table 6.2, the market context is characterised by existence of support, external, internal processes and the adoption of mature technologies. Like most business interest, this particular project case regardless of the features as shared is plagued with institutional challenges, which, ultimately leads to delays in project timelines.

The market context from the earlier exchanges has been noticed to have an influence on the DM. The nature of the organisation is another element likely to influence DMP. It was mentioned in earlier cases that organisational structure imposes a sense of hierarchical flow through which decisions are implemented. In this case, the organisation is centred on the Entrepreneur. There is a sense that sole responsibility of decision-making rests on the shoulder of the Managing Director. The responses from the interview were very personal and person centric, a lot of references to "I" signifying that the respondent had the responsibility to decide or delegate functions after establishing a suitable direction of choice. A few instances are shared of responses.

"I tell you if not because I am a national patriot like I am and that Nigerian Problems must be solved I would have left the power sector", as shown in Appendix 4.0B.

A response to the questions about indicators considered in the process of DM,

"I know what you are asking but I have taken care of that. Let me tell you the process maybe it will help you", as shown in Appendix 4.0D.

Finally to the question about strategic requirements

"Ok first of all you have to look at the project holistically when you are starting which is as an entrepreneur what do I do" refer to Appendix

The responses corroborate the assertion of responsibility on the Managing Director, this is more compelling since the respondent identifies as an Entrepreneur and in a particular instance made the point to differentiate an Entrepreneur developer from a large company as shown in Appendix 4.0E.

Although a direct mention of the use of external partners on the project in question was not explicit, it is conceivable to assume that due to the lack of expertise that partners were utilized to achieve statutory requirements as suggested by the regulatory bodies. However when it came to decision-making on the subject of progression through the stages as stipulated by the regulatory body, the entrepreneur developer had the final say. This is quite typical of organisations in there formative stage of development because they may lack established internal routine processes. Routine decision processes are decisions implemented around established protocols for which expertise and experience has been gained through recursive implementations. Therefore, with this as the first RE project for Company D, the absence of established routine can be assumed as such the involvement of the power holder in this case the entrepreneur through every step of the DMP is logical. This will be different in organisations that are hierarchical, where managerial lines and points of authority are utilized for routine decisions, with progression up the managerial ladder as decisions become more strategic.

In the cases of Company B and C there was a clear segmentation through the various process stages indicating who was involved and where the power rested, basically the riskier the decision the higher the authority required for its approval. The structural relevance of organisations and its direct impact on who make decisions is noticed in this case but this decision-making behaviour cannot be directly linked to market transition. Having considered who drives decisions, it was important to look at how processes are structured.

One of the propositions was to look at process structure through the different stages of market development, in the case of company D, the market showed features of emerging and mature. The assumption from the Table 6.2 suggests that process structure gets more defined with progressive market maturity. In this case there was considerable structure even though institutional issues were raised. The external process as described by the respondent is highly structured but there were failings in areas of coordination, which has been linked to institutional and bureaucratic challenges, a potential concern for potential developers.

The second proposition considered the effect of market transition and context on viability assessment. In the absence of market transition, the responses to the viability matrix are reviewed from the market context perspective as it applies to the current state. In this case the viability from the firm's perspective is a measure of the ability of a project to reach the goals of fit, function and flexibility. The ability to meet these interests ensures the existence of the firm. In other to achieve this, the respondents mapped potential indicators that meet these interests.

The respondent associated 15 indicators to the fit theme, 7 indicators to the functional theme with none to the flexibility theme. The responses show that indicators reflecting economic interest such as cost and rate of return were the focus; the social element of interest was that of potential carbon emission savings while elements such as grid availability and resource availability matched against technology are captured within the fit theme. Although the market state was considered to be in its initial stage of development, the interest of the firm did not solely emphasis on function or performance as expected. It also focuses on securing return on investment as well. The idea that the market environment shapes the interest of a firm is epitomized in this case, since the market is classed as initial. The fit theme represents the strategic interest of the firm in the Company D case has technology maturity as an indicator that must be met for viability to be achieved. It is different as compared to the Company B where technology maturity was not associated to the fit theme since solutions used have been proven. From the theoretical perspective the firm exists only if knowledge about their operating environment continuously led to adjustment in capability (Prajogo, 2016). The absence of experience has shaped the need to ascertain technology efficacy for firms in the initial market state and the need for grid availability becomes the technology interest as the market moves towards maturity.

Finally, in addressing the question of indicator prioritisation in the prefeasibility stage, the respondent identified a total 13 indicators were associated to this stage with 9 indicators considered to be priority indicators. However, of the nine (9) priority indicators five (5) indicators selected were unique to the fit and one (1) for the function theme. There is an obvious prioritization toward achieving fit within the overall viability framework with both the viability themes and indicator prioritization.

6.3.5 Project Perspective of Company E

Company E is a non-indigenous energy development company operating in Nigeria, one among the 14 independent power-producing companies as recognized by the Nigerian Bulk Electricity Trader (NBET). Its core interest is developing Greenfield renewable power projects in emerging markets especially in African countries with Nigeria as one of her interests. The strong local presence and experience has allowed Company E to secure transactions worth $10billion in Africa, particularly in Nigeria. Company E played the role of the lead transaction adviser that facilitated the sale of 10 gas-fired power plants. Essentially a sound local presence has been established in the Nigerian power sector. The project of interest is a 80MW solar project in Northern Nigeria. The interview with a respondent alongside documentary analysis forms the body of the analysis below.

6.3.5.1 Risk and Sustainability analysis for Company E

The risk and sustainability question is addressed on the basis of the response to the question of choice and how it was established. The respondent identified the existence of a need, which is fundamentally the gap to be served. From the sustainability standpoint, this corrects the energy deficiency gap and as mentioned by the respondent expands the local power generation portfolio beyond dependence on gas and hydropower. From the environmental standpoint, the project addresses the carbon emission problem by introducing a low carbon energy option, with the inherent social benefit of addressing the social need of energy deficiency. The respondent indicated that the consideration of renewables as a generation option was an easy sell when compared to other local generating options as shown in Appendix 1.1A. The sustainability argument for renewable solutions has always suffered in the light of the potential economic value delivered, especially in the short term both to the consumers and producer of services and products. The business case for renewables is different across countries with some economically sustainable with price support offered in the form of feed in tariffs or long term PPA's as is the case in Nigeria, therefore Company E has some level of certainty for its revenue stream. In countries such as Germany and Brazil, the photovoltaic and ethanol options are now economically sustainable without the aid of market-based support, however Nigeria and the UK still require price support.

On the issue of risk, although there is an acknowledgment of the market state as initial, the firm's interest is delivering bankable outcomes, which translates to profit. Consequently establishing the right tariff regime was the first concern mentioned by the respondent pointing to financial or market risk, as shown in Appendix 1.1B.

The second risk mentioned was technology, it was considered from the standpoint of cost and reliability. In the absence of locally tried and tested solutions, the respondent indicated that the technology to be adopted was a source of considerable risk. However, with evidence of similar solutions within the sub-Saharan region, a tender process allows for the isolation of a reliable service provider. Essentially the risk of interest were market/financial and technology risk, interestingly there was no mention of policy risk which was questionable considering that the respondent indicated been in the initial market stage of development. This can be attributed to Company E extensive knowledge and experience in the Nigerian power sector or its overestimation of confidence in its local expertise to navigate the local electricity sector.

6.3.5.2 Market Transition, Context and Decision-Making for Company E

Company E although an independent entity in terms of the service and its target market, is a wholly owned subsidiary of her parent company. This introduces an element of structure and organisational hierarchy in the way decisions are processed and implemented. Also considering the market transition proposition, the firm's interest in emerging markets may undermine the market transition proposition however it is of interest to compare the features of her reported market position against the developed framework in Table 6.2.

TABLE 6.11 Matrix for Market categorisation and process definition

Market Stage	Market Transition	Process	Support	Technology	DMP	DMP Actors	Viability
Initial		Internal Process exists but no external process	PPA	Tried but not locally tested	Exist	Internal External	Fit (17) Function (3)

The market representation as observed from the representation is displayed in the Table 6.11. The respondent identified its market of operation as being in its initial stage, this ties to the company ethos of having interest in projects in emerging markets as such the choice of Nigeria is logical. Comparing the information shared by the respondent to the features displayed in the market, there exists a regulatory board in the host nation which outlines the process requirement for the RE projects.

This indicates the existence of an external process but the respondent's opinion was that although there seems to be a system, it is incoherent.

In terms of technology, the documentary analysis shows that the firm is open to trying out solutions as has been shown in its interest in other renewable energy projects in other parts of Africa. The Nigerian project is the firm's first solar project; the operating environment lacks technology competencies as such the project relies on technologies developed externally. The technologies to be introduced are mature but not tested at the utility scale locally. The lack of local technology is a sign of low investment in the research and development in Nigeria. This shortcoming directly affects costing of projects and heightens the technical risk associated with projects. In terms of support the respondent acknowledged that the administered form of support is the PPA that is agreed upon by the generator and the off-taker NBET.

The notion of transition, market context and influence on decision-making is addressed with the account of the DMP as adopted by the respondent. The DMP as defined by the firm is standardised with its processes adjusted to suite the regulatory constraints as presented by the regulatory board. It is worth noting that the respondent mentioned that there was never a means of measuring the level of confidence in the project until the permits for land was obtained. This points to the use of intuition in the DMP as adopted by Company E, although there is a standardised internal process, the uncertainties as presented in the market of operation shaped the behaviour of the DM. In addition, the experience gained by the firm in its operations in the market also contributed to the sense of comfort it exhibited even in the chaotic nature of the market.

In addressing the second proposition, although the respondent supported the existence of transition it was not necessarily seen to have affected viability assessment. The responses as applied to the current state are reported. The respondent placed emphasis on 17 fit criteria with 3 functional criteria with no flexibility criteria considered.

6.3.6 Summary of Cases

The 5 cases considered in this research showed how varied the RE market space can be. The market representations reported were either initial or mature across the 5 cases; the 2 UK cases and 1 Nigerian case classified their market as mature. Similarly, 2 Nigerian cases associated their market with the initial stage of market development, this related to their experience with technology and the state of the electricity market. The 2 UK firms acknowledged been in the mature market when they considered their operations in hydropower and onshore wind generation. The sense of market maturity for the UK cases aligns with the technology innovation trajectory. The market transition noticed was backward in both UK cases with mature markets deteriorating because of changing support and policy framework. The case of leap frogging was also noticed in the Nigerian cases as compared to transition with the market showing more features of emerging market without necessarily going through the initial market stage. These different market representations are associated to varying strategic objectives and risks. In terms of risks, market risk, technology risk and regulatory risk appeared to be the most reported across all cases. Market and regulatory risk were found to directly influence the ability of developers to finance projects and secure return on investment. Regulatory risk was associated with policy risk which defines support offered for development of RE. It is also linked to sector stability as changing regulations introduce uncertainties, which affect the ability of developers to estimate there bottom-line. The argument for tailoring policy to match specific development environment comes to the fore in the case of development of renewable solutions. Germany has succeeded in its attempt at promoting renewables by developing policy to support both large-scale and small-scale developers. A country like Nigeria can learn from such approaches to change its electricity landscape. Technology risk was associated with project delivery timelines in the mature market cases while technology reliability and maturity were concerns as it applied to the initial market cases.

The varying market of development context was noticed to have shaped the DMP, as it promoted increased rationality in the form of logical incrementalism and procedural rationality. Regardless of the stage of market development, developers adopted standard processes in deciding on what projects to take up. Finally the viability framework indicated developer strategic intent as established by indicator and theme association.

6.4 Comparative Analysis of Cases

The cases considered so far have shared quite a significant amount of similarities and differences; this section looks at them on the basis of market segmentation, decision-making process and viability considerations.

6.4.1 Market and Developer Segmentation

From the responses shared across all the cases, there is a sense of overestimation by three (3) of the respondents when it came to identifying their market position. Two companies in the UK and one in Nigeria identified their market context as mature; this representation is reflective of their perceived state of comfort with technology used. However they all relied on support for revenue security which when compared to the features as identified in Table 6.2 contradicts the mature market representation.

One of the goals of this research was to identify if there was a conscious movement by firm through stages of market development as expected in the innovation cycle. There was no noticeable forward movement from initial to emerging through to mature in the cases considered however the two UK company cases acknowledged the fact that what was once considered a mature market had deteriorated into the emerging form with both cases having their assumed point of market entry as mature. In the same vein one Nigerian case respondent acknowledged that there was going to be a lot of learning that potentially will lead to movement from current initial market through to a more mature one.

Looking at the features of market description, the cases can be considered to be located at the boundaries between the market stages as indicated in Table 6.12. This is fairly distinctive from the market stages as suggested in Chapter 3. So although, it was assumed that market stages are finely defined, the positioning as observed from the exchanges is not explicit. Shared features between market stages have been predominant which also points to the transitive nature of the markets.

The UK cases showed features of emerging and mature market attributes while the Nigerian cases showed the features of initial and emerging markets. This is plausible since the renewable energy market is still developing in both countries. Also this shows that UK based firms selectively locate their business interest in markets that are assumed to offer the best outcomes at the time with the anticipation for transition to more market driven stages. Similarly the Nigerian IPP's participate in the market on the basis that it offers outcomes, which they consider, compensates for the investments regardless of the maturity of the market.

TABLE 6.12 Reported and Actual Market Positions

Cases	**Reported**	**Actual**
Company A	Initial	Initial / Emerging
Company B	Mature	Emerging/ Mature
Company C	Mature	Emerging/ Mature
Company D	Mature	Initial / Emerging
Company E	Initial	Initial / Emerging

The maturity of technology adopted is not a direct indication of the state of the market. As has been shown in all the cases, mature technologies are transparent across geographies, however experience and competence accumulates with maturity of market.

The idea of heterogeneity in the categorization of actors within the development sphere is highlighted in the cases considered. Segregation can be established amongst developers as shown below Table 6.13 and this is on the premise that these developers can be differentiated by their level of vertical integration with the most integrated been the Utility and the least been the Entrepreneur; with four identifiable categories, which are the Utilities, Experienced Developer, Inexperienced Developer and the Entrepreneur.

TABLE 6.13 Developer Categorized

Cases	Developer Categories
Company A	Inexperienced Developer
Company B	Experienced Developer
Company C	Utility
Company D	Entrepreneur
Company E	Experienced Developer

6.4.2 Risk and Sustainability

The market transition and context position was the lens for considering risks; the assumption was that risk considerations would significantly vary across the different market contexts. Although the cases are positioned across different market contexts, they shared similar concerns when risk is considered. Respondent generally reported Four (4) different risk categories; they are market risk, technology risk, construction risk and regulatory/policy risk. These risks are consistent with existing literature however using the notion that environment shapes organisational objective and the antecedent risks; one could assume that risk prioritization will be a reflection of the stage of market development. This was not totally obvious, however certain interesting assertions can be made. Three of the five cases explicitly ranked market risk as the most important, this can be attributed to the fundamental nature of firms as profit making agent, in the case of renewables where cost externalities pose a challenge to DM. It is understandable to experience market risk in mature markets where uncertainties are introduced by changing commodity prices. However in the renewable electricity market the availability of support is targeted towards correcting for cost externalities emanating from the cost of production system but market risk is still reported.

Market risk is highly associated with policy and regulatory changes. This is evident in the renewable energy sector especially as nations attempt to make renewables more competitive and attractive for developers. It is plausible that the relevance of market risk is related to the attendant effect its association with policy and regulatory risk could cause to the financial stream of the firm. The next risk of relevance is the policy and regulatory risk; this is significantly related to the market risk. In a highly regulated system where support and policy drives major decisions, companies are known to need long-term signal as shared by respondent to participate in the market. An alteration in these signals such as changes in policy support mechanism that directly contribute to cash flow streams have the potential to affect developers and investors negatively. For cases classified as initial and emerging markets, this risk will be assumed to be quite significant since the market requires incentives and structures to drive innovation and participation; however the reported cases favoured market risk over regulatory risk. The last two risks, which are technical and construction risk do share similarities as they emerge in the development stage as compared to the first two, present through the life of the project. These risks are associated with the core deliverable which is electricity generated, in terms of market transition one will assume that these risk will be ranked top for cases in initial market followed by policy risk for emerging markets and least for mature market. Basically with growing experience and expertise the construction and technical risk should minimize, this is corroborated by the depiction as shared for the companies in the UK.

For the cases in Nigeria with competence issues this risk was ranked lowest. This could be attributed to the overestimation of probability of success even in the absence of local evidence of technology use, secondly with most project of this magnitude implemented by third party companies, an effective request for proposal delivers the best kind of service for both technology provider and construction partners.

6.3.4 Decision making process

The initial assumptions that formed the foundation of this research were built on the notion that investment decisions and processes are fundamentally shaped by environmental influence with the role of cognitive influences already established in research. Although, the influence of the environment is significant in defining how organisations perceive and operate in their market environment, understanding how market context affect process was yet to be fully explored.

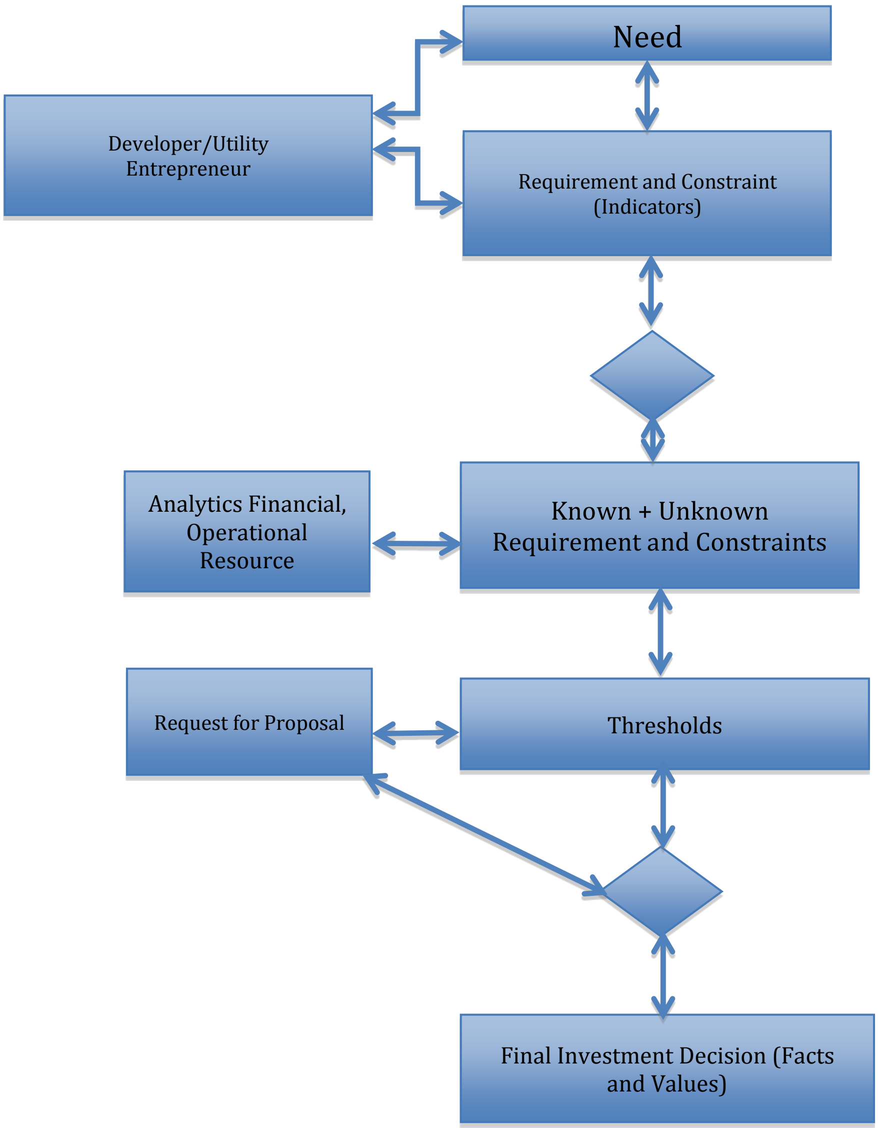
There was no clear evidence of firm's progressive transition through identified market stages, however there was evidence of standardization of process in all the reported market stages regardless of maturity level, which was unexpected in line with the features of Table 6.2. It is evident, that there exists a relationship between type of developer and power dynamics as applied within the DMP. The more vertically integrated the firm the more structured the process with all clarity in designation and decision activity however this changes at the end of the spectrum as in the case of the Entrepreneur where all decision both routine and strategic ones revolve around the decision maker. Although it may seem fairly obvious due to the difference in structure and level of dependencies that differences should exist, this is further escalated with the argument that power dynamics should play a significant role in the presence of munificence as seen in the financial market where expected profits led to an adjustment in behaviour of the players.

This was not the case across the different developers as standards were maintained, the unifier in the case of rationality of process is the underlining regulatory requirement introduced by the environment in this case. However, this does not influence the definition of authority and distribution of action within the firms. In terms of the organisational perspective, viability assessment is fundamentally a part of the DMP discourse; the approach to assessment as considered within this discourse is high-level as it focuses on overarching interests or goals and the indicators that represent them. Putting it all together, the decision-making process and viability framework show that significant value lies in the already existing normative approach as developed. The attention placed on the particular interests of DM in line with the interest of the actors is highlighted in this section. The three areas of interest as noticed from the data are authority and use of power, process and viability interest and operations.

6.3.4.1 Authority and the Use of Power

Earlier in this chapter it was mentioned that environmental influence, particularly market context could potentially impact on authority and action considering firms organizational structure. Consequently, the argument as it relates to routine and strategic decisions is examined, there are power and authority allocations when it comes to decisions as is seen in the cases considered. From the data, the order of priority for action around decisions is structured to progress with level of resource involvement and intensity as compared to level of analytical complexity as reflected in Figure 6.1.

FIGURE 6.1 Decision Process Map



The figure was developed from the process representations as shared by the respondents across cases. In the utility and developer styled companies where structure has been formalized, after the need to develop renewable energy solutions has been established, the authority for action on decision to build, define and reduce uncertainty around a potential project lies at the level of middle management. These actions are considered to be routine decisions, which have established protocols as epitomized in the staged and gated approaches. These protocols could be classified as organizational artefacts, which have been accumulated through learning and process documentation. In the case of the inexperience developer, the authority is shared between top management and the third parties who have accumulated knowledge. However, with progression through the decision-making map as shown in Figure 6.1, analytical processing and refinement reduces as the weight of decision making responsibility increases.

There is a transition of decision-making role to top-level management when final investment decision is to be made and from the data it is a combination of established fact about prospective project and the value of the company in question. In the firm, the assumption was for the presence of munificence to drive CEO’s to be more aggressive with development but the evidence shows the opposite, which is ascribed to the legacy and style of doing business. However, the Entrepreneur developer has sole authority and responsibility of action based on the structure of the enterprise.

6.3.4.2 Process and Viability Interest

From the decision process map in Figure 6.1, the decision-making pathway involves processes, which are internal and external. The internal process involves the firm and shareholders while the external processes involve firm, regulators, suppliers and project beneficiaries. These actor groups have different interests and as such meeting these as decisions progress is essential.

In the process representation as gathered from the data and displayed in the Figure 6.1, it begins with the establishment of need. This marks the beginning of the DMP, fundamentally the firm defines and establishes it interest, which is in agreement with the theory of the firm. However rather than the maximizing approach as advocated by the proponents of the theory, the approach as noticed is more of a satisficing approach where utility is valued on the basis of available information and this improves with time. While considering the entire process map holistically there is a sense of the existence of a forward and backward loop between formation of requirement and action. Starting out with the element of need, it allows for the organizations to define and form their entry requirements, these requirements must capture the interest of all stakeholders as such shaping expectation and performance. The viability assessment framework is handy in this part of the process as it forms a top-level tool, which can be adopted at this diagnostic stage to establish coherence of idea with organisational and strategic need. The process map progresses to identifying operational requirements and actionable expectation that meet the established requirements. At this point, extensive assessment and refinement are actions that follow after developing operational requirements, which leads to the development of final decision-making thresholds. The final DM threshold is developed with the action in this stage being the final investment decision.

The decision process map can be linked to the viability assessment framework. The problem definition stage is where need assessment is conducted, the emphasis as shown by most respondents captured elements of fit and function interest, and here the respondents were seeking to establish the minimum allowable strategic and operational requirements in other to ascertain project viability. The fit elements considered were regulatory, financial and social while the functional captured the technical related requirements as all respondents were interested in evacuation of produced power, establishing a match between resource and potential solutions and finally looking at ease of implementation. The flexibility theme did not play any role in the problem definition stage.

In the Solution Definition stage the emphasis as shared by most respondent's lies in the theme of function, this is logical since with the establishment of project goals and requirement, the quest is to figure out potential solutions to generate and deliver value. This stage involves assessment of both internal and external technical and economic factors (competence, resource, technology and financial assessment) that will support the achievement of the requirements as developed in the problem definition and diagnostic stage. The assessments in this stage are continuous and undergo progressive refinement with the availability of more information. In this stage some level of capital allocation for scaled development projects are commissioned which further authenticates the information generated by conceptual assessments. The final stage is the Financial Close Stage where generated information from the solution definition stage is matched against the problem definition stage. Here all elements of fit, function and flexibility come together. It is worthy to mention that at this point the factor considered under the theme flexibility is the integratibilty factor that shows the ease to fit into an existing generation portfolio as is the case for Case A. The modularity factor was not considered since development projects are size specific, so although scalable solutions such as solar PV are attractive that does not add to value delivery for large scaled projects.

6.3.5 Viability Assessment

Having looked at the renewable energy development as one that could be described using the innovation cycle framework, with different stages of market development posing unique challenges and opportunities the assumption that substantial variability in the underlining strategy for developing these solutions was logical. Assuming the assertion of variability is plausible; it also can be argued that this will affect the definition and development of representative decision-making indicators as suggested by Bossels. To verify these assertions the adapted viability framework was tested among respondents using indicator association with themes, fit, function and flexibility when considering their renewable energy projects as a means to identify their strategic direction through indicator prioritization. Therefore the viability of a project will be reflective of the indicators as prioritized by the respondents.

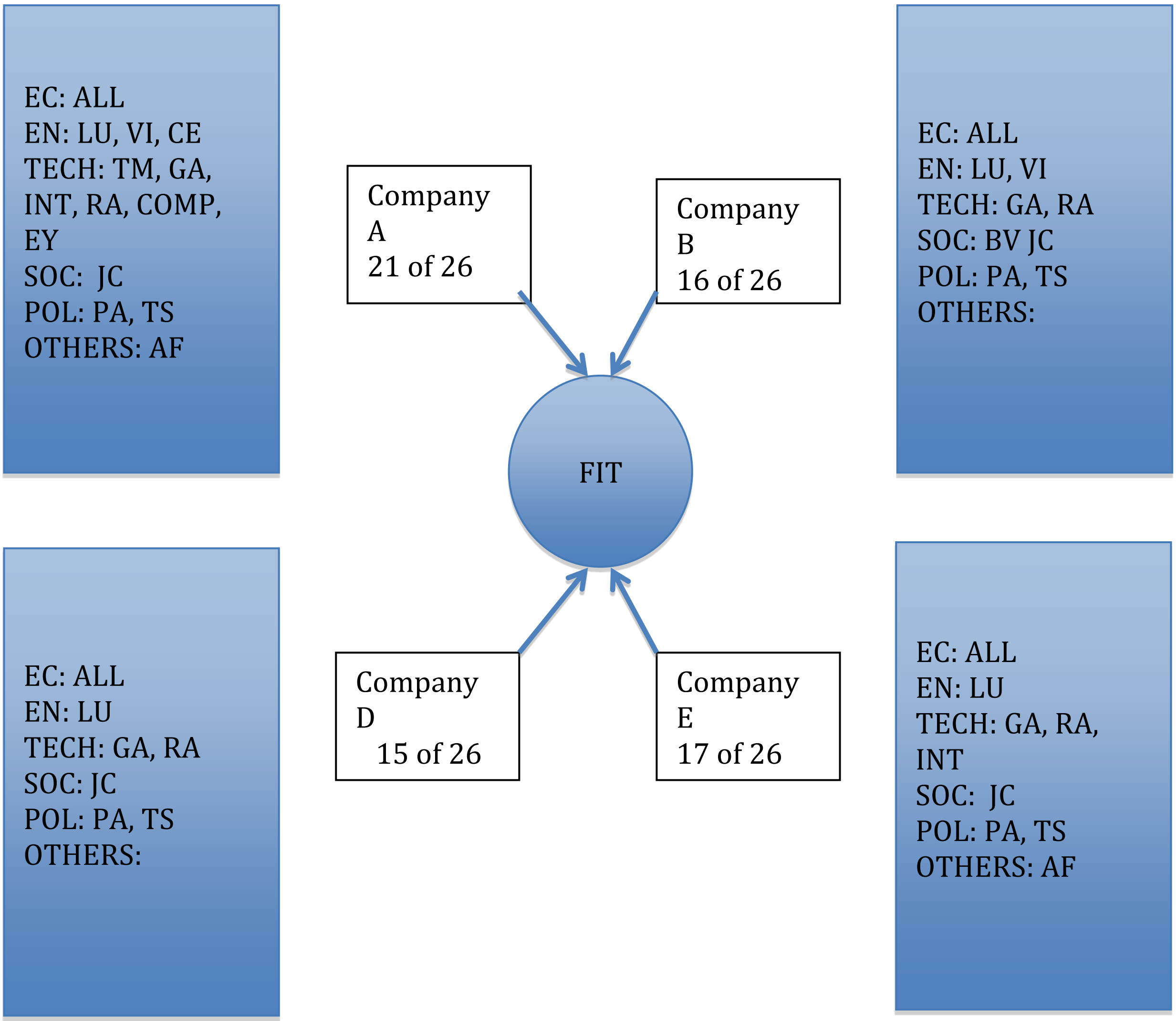
As stated earlier, it was assumed that the varying state of market development should influence indicators interest. This is done by decision makers associating indicators to specific themes according to its suitability in meeting the development criteria and strategy. A general categorization of the indicators into economic (cost and revenue), social, environmental, technical (direct and indirect) and others has been adopted. The Table 6.14 below shows the indicators for the various categories and how they were distributed into theme interests.

TABLE 6.14 Indicators and their Categories

Categories	**Indicators**
Economic (cost and revenue)	Return on Investment, Payback, Levelised cost of electricity, Net Present Value, Internal rate of return, Investment cost, Operation and Maintenance Cost
Social	Brand Value, Job Creation,
Technical (Direct and Indirect)	Technology Maturity, Competence, Modularity, Integratibilty, Grid Availability, Carbon Emission, Resource Availability, Land Availability,
Environmental	Carbon Emission, Land Availability, Visual impact
Policy	Tariff Sustainability, Policy Attractiveness
Others	Access to Finance, Presence of a Supply Chain

The above table is used alongside the market context dimensions already established for the different cases. Similarly the indicator association map Figure 6.2 below shows the case and indicator associations around the various themes.

FIGURE 6.2 Associations of Indicators with Fit



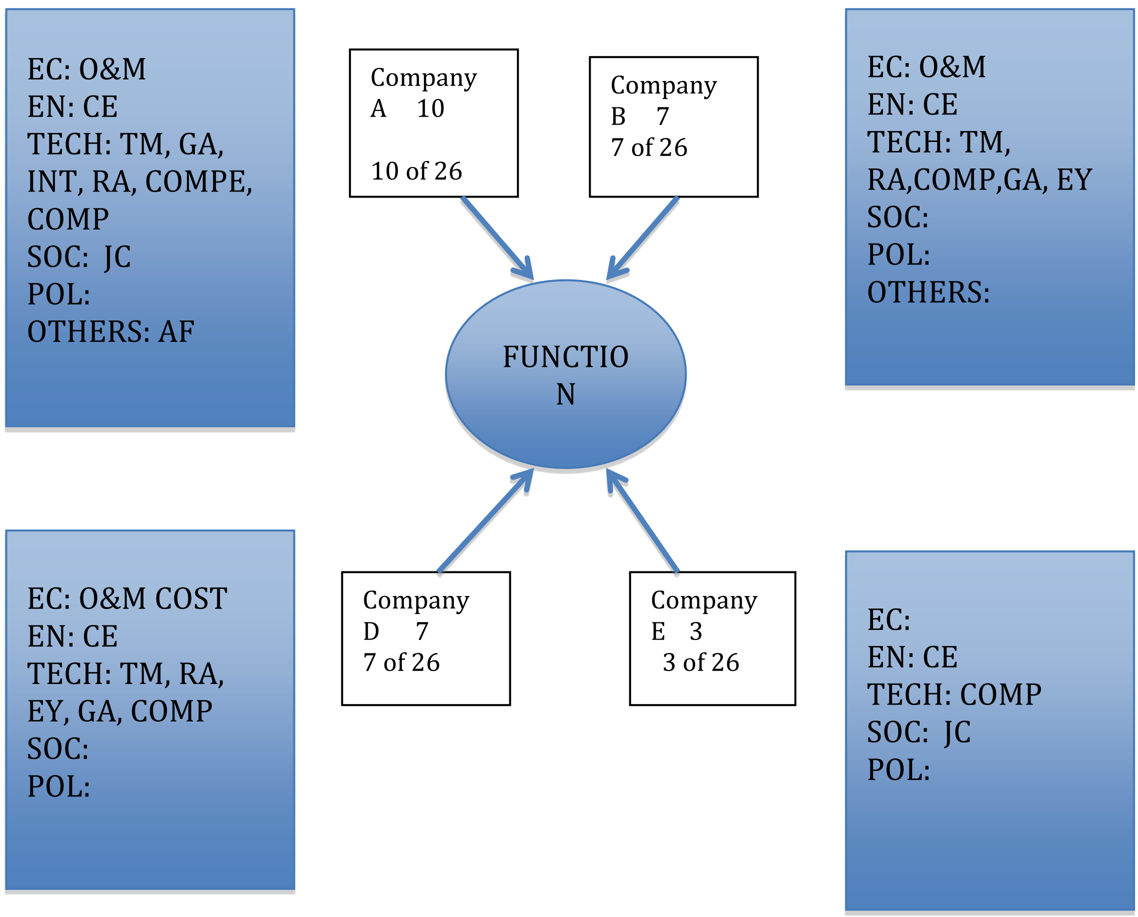
The FIT theme essentially sets the stage for the definition of actors (investors, developers, environment, regulator and consumer) core requirement and constraints; as such it is plausible to see that a significant concentration of indicators is associated to this theme. Case A displayed features of initial and emerging market with 21 out of the 26 indicators associated to the FIT theme. Case B displayed features of emerging and mature market with 16 out of the 26 indicators associated with the FIT theme. Case C was similar to Case B with respect to market representation however they considered the framework too subjective so no responses were offered, Case D had 15 out of 26 indicators associated with the FIT theme and finally Case E with 17 out of 26 indicators associated to FIT. Although all four cases share similarities there are identifiable differences, this is analysed along market lines. The cases identified that lie within the Initial and Emerging market associated all the economic indicators to FIT, as stated earlier although the market is not developed the actors are profit driven as such priority is given to securing return on investment. Similarly all cases associated same indicators to policy and social category however differences were noticed in the social and other categories. Case A and E associated the need to access funds to the FIT theme with no association for Case D. This indicator was considered strategic since projects of this scale require project finance either internally or externally however the non-association by Case D is rather unexpected however it is explained by impression that capital is constantly in search for viable projects that match acceptable risk profiles. Another marked difference in the responses was with the technical category, Case A differed from Case D and E as the respondent associated both direct value and non-direct value technical indicators to the theme while it was the non-direct indicators for Case D and E.

Essentially there was a level of separation between cases in their associations with direct and non-direct technical indicators, which is reflective of their experience in developing the wind or solar renewable projects. It is less of an issue for case E as there is experience in delivering hydropower projects in parts of Africa so sourcing and executing projects of large scale have been mastered but that is not the case of Case D. Case D is unusual especially for a company with no existing experience in delivering such large scale projects, it has been shown that DM tend to overestimate the positive probability of positive expectation and that seems to be the case. Furthermore since project implementation is a transferred activity, the burden of performance is passed on to the contracted EPC.

So considering similarities and difference across markets, case A, D and E identified as having features of the initial and mature market position had the same economic and policy interests as Case B indicating the interest to secure profits regardless of the market stage of development. Interestingly Case D, E and B associated similar indicators to the technical interest; these indicators were the non-direct indicators. The technical indicators have been segregated into indicators that account for direct value production and associated value production. Direct value production indicators are those that either facilitate or are a product of the generation of power and the latter facilitate the delivery and overall running of the system. It was expected that in the absence of local evidence in the case of D and E, that an association with the direct value indicators will be prioritized however that was not the case. The non-association as noticed in case B can be attributed to accumulated knowledge and experience with the use of mature technology and experience with project execution however for Case D, E it can be attributed to overestimation of positive expectation in the absence of local evidence of reliability in technology. Nevertheless all cases had established association with the non-direct technical indicators, these essentially facilitate the delivery of value generated in the form electricity and noticeably they are mostly out of the control of the utility or developer as such estimating the probability of positive expectation is critical and that explains its position within the fit theme.

On the other hand elements such as maturity of technology, competence are established and controllable parameters that are associated with function. In terms of difference, Case B associated Brand Value to Fit, which is not considered by other Cases as related to Fit, this can be attributed to existing reputation which is missing for the other cases. From the strategic standpoint, protecting the brand value translates to protecting the reputation of the company which is synonymous to established firms like case B over the likes of Cases A, D and E who are just new entrants in the sector.

FIGURE 6.3 Associations of Indicators with Function



Case A, B, D, and E all considered both direct and indirect technical parameters that is logical since this theme accounts for all that connects with operations as shown in Figure 6.3. However Case A differed from B, D and E because it captured the element of Compatibility and Integratibilty that in the opinion of the respondent addressed the issue of impact on grid and environment. In the case of Company B these effects may have been established especially with the experience of executing large-scale renewable energy project. From the Economic standpoint there was the association of O&M cost by Case A, B and D as an economic factor with the exclusion in E. All three cases have O&M cost in the FIT theme which makes this indicator quite strategic however the presence in the FUNCTION theme could be attributed to the interest in cost reduction. O&M cost is a long-term cost as compared to investment cost that is one off, so there is the interest in lowering or maintaining the cost while ensuring optimum performance. In Case A access to finance was included within the FUNCTION theme the assumption been, the respondent in this case associated the ability to finance the project as both a strategic and operational requirement. Essentially the functional theme is consistent with the notion that secondary objectives are targeted towards achieving and meeting the primary objectives as outlines within the fit theme.

Finally looking at flexibility, respondents from case A, B, C, D had negligible impact on association of indicators.

6.4 SUMMARY

This research explored the DMP as it applies to RE development from the project developer perspective while considering the role of market. It also involved the adaptation of the Bossels viability assessment using a system-based approach to the Viability assessment framework. The need for an alternative assessment of viability was built on the notion that existence of a renewable energy project is established on the ability to meet the requirements and constraints imposed by its regulatory and operating environment; therefore, viability by extension is a measure of performance. Although viability is the grounding idea behind this research, viability assessment is a process within the organisational decision-making process, hence making the consideration of DMP imperative. The RE sector is known to constantly undergo changes, changes in market structure, implementable technologies and policy amongst others which introduce uncertainties typical of any innovative system. Although these pose some challenges it also provides opportunity for development and growth through the provision of government support and incentives which marks it as a munificent. It has been suggested that environmental munificence has the potential of introducing slack to organisations and particularly affects their DMP in ways that redefine the extent of rationality noticed within the DMP. In addition, there is the assumptions that firms evolve thereby transition through different market stages of development as stated in Section 3.2 introducing different environmental influences that influence DMP.

Beginning with the argument about market transitions, the theory of the firm has established the existence of firms as bounded around the interest of stakeholders to secure profits. Hence profit-oriented firms identify the most secure markets for their operations as such there is no conscious movement to start in markets that do not offer any form of financial certainty as noticed in the cases considered.

However there is the acknowledgement that market conditions change, these changes could either improve or deteriorate the market state. Similarly, the evidence shows that there is more likely the case of backward market transition but this does not compel the existing established players to exit the market. Rather they reinvest in market strategies that foster their continuous existence in the market by introducing private PPA's for corporation willing to do more to enhance their environmental compliance.

Having acknowledged the absence of clear market transitions, the DMP dimension (rationality and process) from the evidence in cases studied also follow the normative pathway as established in literature (Mintzberg, Raisinghani and Theoret 1976;Simon 1979; Dean and Sharfman 1993,). RE solutions are strategic making them inherently complex, however certain elements of the process are routine based with complexity increasing with progression. The issue of rationality was also explored on the premise that munificence could lower the level of detail and procedural practice within the DMP, this was not the case since the market is externally regulated as such progress depends on compliance with process and development requirements as shown in Figure 6.1. Therefore, dependency shaped the DMP across the various cases considered, however the role of organisational structure plays a significant role in influencing rationality in process. The place of organisational structure introduces hierarchical ordering with emphasis on authority and its potential misuse, which could affect rationality.

In addition, the evidence shows that DM combines the use of value and fact. The different stages are the basis of progression across the DMP that is a depiction of its procedural nature displayed across the different categories of developers.

Having explored the transition market argument and DMP, the risk representation as captured by the developers in their self-identified markets of operations was explored in line with the first research question. Several risks were reported with reoccurrences across cases, however the market risk was considered the most important as it was the most pressing in four (4) of the five (5) cases considered, which points to the prime interest in securing projects or maintaining an appreciable level of expected return highlighting the profit maximization goal of the theory of the firm. The mature market was favoured to associate more with that risk, however noticing the same prioritisation for the less mature market cases raised the question of why the focus was not on technical risk, since in a less mature market concerns about technology reliability plausibly represents the objective of focus. This was answered by the notion of technology maturity been transparent across geographies meaning that a mature technology would work by replicating operating conditions across geographies regardless of the market maturity argument. This is also strengthened by the argument that firms in markets classified as less mature may not necessarily be involved in project implementation hence rely on third party service providers with the experience and competence to deliver projects at standards accepted globally. So far for less mature market cases, there is an over estimation of the probability of success however this is supported by built in risk management strategies in the form of guarantee of service contracts offered by the third party firms. The next risk of importance is regulatory or policy risk, the RE market is regulated as such changes in the environmental and operational requirements have the tendency to directly affect market outcomes particularly expected cash flows. The last two risks are construction and technical risk linked to the development and operational stages of the project.

Having considered risk, the viability framework showed that respondents identified more with two of the three themes within the framework, which are FIT and FUNCTION while interaction with the FLEXIBILITY theme was minimal. The respondents associated indicators that reflected the primary objectives of the firm to FIT and secondary objectives to FUNCTION with only CASE E associating two indicators to the FLEXIBILITY theme. The lack of association with the flexibility theme can be attributed to nature of renewable projects, which are long-term with little or no significant change expected after completion.

Finally, for the company cases where experience and expertise was missing all categories of indicators were associated with the FIT theme with minimal separation between primary and secondary objectives but in cases where experience had been gained separation is noticed between primary and secondary objectives. The association of indicators to interest show that companies with experience are more interested in maintaining their financial returns while ensuring that technical (indirect) indicators are established since reliability of technologies have been established. In terms of policy definition regardless of maturity in market, policy makers have to ensure that the framework that portray stability in market are maintained and this applies for emerging markets as well to facilitate diffusion. Finally, since technology reliability can be established with project implementation or pilots, developers are more interested in the allied technical parameters such as grid availability, competence and cost correction strategies, which ensures that services are uninterrupted.

CHAPTER 7 CONCLUSION

7.1 Introduction

The previous chapters have addressed the core ideas, methods and analysis of findings. This chapter presents the major outcomes of this research in Sections 7.2, 7.3 and 7.4 with future recommendation in Section 7.5. In reaching these conclusions, the match of outcomes against developed questions and aim and objectives in order to know the extent they have been met is outlined in the sections below.

The research aim was:

To establish the extent to which viability assessment and process definition are affected by the process of market transition in the renewable energy development environment.

The objectives were:

1. To establish the link between risk and sustainability as it relates to renewable energy projects.
2. To develop and validate viability assessment framework
3. To identify the effect of market transition on process and viability assessment within the development of renewables
4. To establish the existence of indicator prioritization within a stage of development.

Research Questions

1) What is the link between risk and sustainability from the developers' perspective?
2) What system-based approaches can be adopted in the definition of viability assessment standard for developers?
3) How does the transition affect the market and process of decision-making?

7.2 Objective 1: To establish the link between risk and sustainability as it relates to renewable energy projects.

This objective was fully met and the findings discussed in Chapter 6. The concept of energy security highlighted the potential risk of inadequacy in supply of energy, which has necessitated the consideration of alternative approaches including renewable solutions.

Utilities and independent power developer are at the centre of implementation of these solutions therefore understanding their organizational perspective as it relates to risk is considered as critical.

The risk perspective associated with the development of RE solutions although extensively covered in literature has paid less attention to the organizational risk prioritisation perspective as it relates to market stage of development. This perspective, asides being beneficial to potential developers, it also is essential for policy makers if they seek design policies to fast track development especially in developing countries such as Nigeria.

Risk identified across different firm types were as follows; policy and regulatory, technology and technical, market and construction. In terms of risk prioritization, three (3) out of the five (5) firms considered market risk as the most important linked to the need to be profitable however the next risk of relevance is the policy and regulatory risk. However, the first time developers found technology risk to be significant which was highly plausible and expected.

Moving forward, for the development of renewables in emerging markets to be fast tracked, there is need to address the issue of market risk as it significantly affects sustainability from the developer and consumer perspective. Tailored financing approaches, which include crowd funding, and community-based renewables have the potential of lowering the market risk exposure which affects the sustainability and viability of any RE project. Also, worth considering is the adoption of new business models by entrepreneurs and large utilities especially in this age of distributed generation. Finally, for emerging markets the definition of clearer development frameworks, which lower regulatory risks, will also aid the diffusion of renewables.

7.3 Objective 2: To develop and validate viability framework.

This objective was fully met and the findings described in Chapter 3 and 6. One of the outcomes of this research was to develop a viability framework, which will support the assessment process utilized by firms in the course of decision-making. It had to be one that captures the organization's perspective. Although this research targeted firms engaged in developing renewable energy projects, the framework is suitable across other business systems.

This research has introduced an alternative approach to the consideration of viability assessment, this in itself is progressive, this new approach looks at viability beyond the project case or technology focused perspective, as has been the case so far in RE research. This new approach focuses on the organisational point of view with the focus on firm's perspective of viability.

The viability conversation within the renewable development addresses policy, barriers, financial, economic, technology and social concerns as is shown in literature. This is shown in the numerous techno-economic feasibility and viability analysis attempts, which involves the systematic assessment of functional ability of the solutions and the potential economic performance for the life span of the project.

This novel approach looks at the viability as a measure of FIT, FUNCTON and FLEXIBILITY of the project from the firm perspective.

This draws attention to the need to consider projects not just on their merit of being technologically and economically sound but also on their overall strategic purpose. The adapted approach was a product of the Bossels approach, which looked at viability from the system perspective with solutions considered as viable only if they fit the purpose of their environment, if they function to meet the need of the environment and adapt with changing environment.

In addition to ensuring the achievement of strategic intent, the viability assessment framework captures market influences introduced by the varying operating environment. It was noticed in the cases considered that firms adjusted their indicators to meet the prevailing market conditions. This idea led to the consideration of indicator association and prioritization. Using the framework decision-makers can map indicators to their various themes as it relates to their market development context. For the decision maker, this can serve as a screening tool which allows the DM to segregate indicators and therefore prioritise indicators whose information are more relevant at the particular decision-making stage.

In terms of policy design, it adds to the tool kit for policy makers, with the knowledge of indicators as prioritized using the framework, policy makers can target specific actor groups and market segments with policy strategies that meet their particular preferences. This can be directly applied in the development of targeted financial incentives depending on the priority of the interested developers

7.4 Objective 3 & 4: To identify existence of Market Transition and Effect on Decision Making and Viability Assessment

This section addresses two objectives; objective 3 was fully met while objective 4 was partially met.

In Chapter 3, market context and transition dimension was used in the consideration of decision-making and viability assessment from the organisations perspective. Since the environment defines the conditions for the existence of any business mapping actual organizational concerns and interest to environmental constrains will facilitate the process of diffusion and promote existence of business. This is needed because there has to be a matching of organization interest against requirements of the operating environment.

The first consideration was the identification of the existence or absence of market transition, the findings as captured within the research shows that all five (5) cases acknowledge the existence of different market stages and elements of market transition. However, there was no conscientious effort by firms to move from a less developed market to a more mature market system but there were cases of leap-frogging in the developing markets. Essentially mature firms strive to position themselves in markets considered to be mature as they take up development initiatives. The existence of potential backward transition caused by market deterioration was acknowledged. Also, the market cases considered were not purely mature or initial as they shared cross boundary features.

Although literature highlights the existence of market formation as essential for the diffusion of innovation, it does not expressly discuss the stages of market development and their progressive effect as it relates to developer and investor behaviour. The focus on the market points to two important concepts market segment and actor groups.

The contemporary discuss especially in current technology innovation studies is about trans-boundary links that innovation leverages in shaping local and international policy. This research contributes to the discourse by pointing to the importance associated with market segmentation as a means of developing purpose driven sustainable innovation. Considering the findings, the emerging and mature markets are characterised by unique combination of actors, institutions and rules, which have been investigated in developed countries but not so much in developing countries. The Nigerian cases involved the participation of entrepreneurs and first-time developers, these groups are structurally and functionally different therefore the development of policies has to be tailored towards meeting their interest as found in their market segments. Understanding the unique requirements of these groups is salient in achieving the effective diffusion of renewables in developing countries.

In terms of decision-making process, processes are assumed to be non-existent in the initial market on the contrary, cases considered to be in the initial market phase had standardized processes but reported challenges due to institutional factors that led to bureaucratic bottlenecks. For the cases in the mature markets they had standardised processes as well however it was mentioned that due to deteriorating market conditions the processes were modified for improved scrutiny to meet prevailing market conditions. Finally, the combination of market segment, actor groups and market context has been loosely explored in the RE behavioural research. The RE decision-making research has solely focused on decision-support tools and methodologies, there is noticeable stagnation in the research on process. The contemporary conversation focuses on strategic choice and behavioural motivations that facilitate choice, with research on process lacking, asides the contribution of Frederiks et al. (2015) which touched on consumer decision making process.

The relevance of the rational approach as implicitly implied with the emphasis on methodologies and decision support tools such as MCA and LCA is challenged from the findings as captured in this research, as the findings show that there is a place for the application of intuition as is seen when dealing with value-based indicators as noticed in this research. Also highlighted was the logical incremental nature of the decision making process as noticed in the emerging and mature context, which was associated with increasing access to information.

This contributes to the discourse of DM theory and its relevance as applied to RE development and more so to the place information availability plays in fast tracking the diffusion process and decision making in particular. Therefore, it is suggested that policy makers invest in information exposure at the different stages of development, as this may be the key to unlock the potentials in RE development in developing countries and Nigeria in particular.

7.5 Overall Conclusion

In line with the set aims and objective of this research, the following conclusions have been reached.

Market risk, Regulatory and Technical (Construction) risk are the major areas of concern for developers both in developing and developed countries. These risks directly affect the productivity of both large-scale and first-time developers. However regardless of size of firm and experience, they all intend to lower market risk to the barest minimum in other to secure maximum returns. This according to the theory of the firm confirms the correction of transaction cost argument.

The viability assessment framework was adapted and tested across 4 cases in different reported market states. All cases placed more emphasis on Fit theme over the two other themes; the Flexibility theme was the least relevant. The Fit theme captured the overall strategic interest, which were significantly different across the different cases. The Functional theme captured operational concerns also different across cases. These marked differences are associated with firm heterogeneity brought about by experience and market stage of development.

It was acknowledged that there is a case for market transition and its effect, although not in a sequential manner. Also, there was noticeable effect on the process requirement as noticed in the UK market. This supports the idea of logical incrementalism that implies continuous process improvement with the introduction of new knowledge and information. In addition to the effect of market transition, the regulatory environment also significantly shapes the decision-making procedures for the UK and Nigerian cases respectively.

These outcomes show that normative decision making processes still form a significant part of organisational life, it also points to policy makers to target the different developer groups along the lines of their development interest. The finding associating market transition to impact on process and definition of viability interest applies to any system undergoing change. Therefore, it has applications in defining organisational strategy and product development.

Finally, the viability assessment framework is a support tool that can serve as a screening mechanism adopted by decision makers if high-level prioritization is the interest. A good example is in the case of multi-criteria analysis, this could be a tool used to screen indicators based on the interest of the actors before using the multi-criteria framework. This has its benefit especially since decision-making is time consuming and capital intensive, the tool allows the DM to prioritise based on their current and immediate needs.

Another practical use of this tool is in the case of product development, which is a cycle-based process. This involves continuous change not just in the product but in the objective it achieves, which must reflect both the interest of the service provider, consumer and the context of implementation.

The focus on DM and the place of rationality has been established in this research as significant not withstanding the market context. Here rationality is imposed on the decision makers by the formal structure as found in large corporations or as imposed the regulatory environment. However, elements of logical incrementalism with emergence of new information currently describes the approach as adopted for DM. The consideration of market context as it relates to the influence on DM is not new however this research introduces this dimension to the decision-making in renewable energy development. This is a first in terms of methodology applies and the scope which covers developing countries and their emerging markets.

The consideration of market context influence on decision-making especially looking at emerging markets has not been fully explored. The focus has been on developing countries especially as they are at the forefront of innovation in the sector. This new direction moves the conversation towards understanding local peculiarities, market segments and actor interest. In terms of methodology, the use of the case study method for DM analysis in RE decision-making research is also particularly with the use of process tracing as an analysis method. This methodology builds on the fact that a phenomenon of interest could be reviewed from varying actor’s perspective offering a deeper understanding of the workings as they happen in the organisation.

Finally, the viability assessment concept is novel it moves away from the traditional project, technology and case perspective and addresses the issue of viability from of a project from the organisational perspective. This therefore offers an overarching standard for which projects could be assessed when further developed.

7.6 Recommendation for future work and Limitation of Study

The research outcomes as stated above are applicable in the areas of policy development and in organisation strategy definition. The viability assessment framework as developed is one of the outcomes, which is significantly new as it addresses viability purely from the perspective of the developer. Having mentioned that decision-making is a cost intensive exercise, this framework aids the internal DM process in terms of prioritization of success factors. Secondly considering the multi-layered and multi-dimensional nature of DMP especially renewables, this framework acts as a filter for factors that can be utilized in other multi-criteria or multi-objective decision making tools. In essence, the viability assessment framework is a high-level segregation tools that can be adopted across sectors that are interested in system-based analysis.

Another major outcome was that of transitions and their potential influence on decision-making process as well as the association with risk. This dimension is significant in the sense that policy makers have the opportunity to match interests and concerns as reported by developers to policy design. It has been mentioned that policy could make or mar the process of development. Therefore the emphasis placed on risk association offer policy makers’ insights on what policy directives to focus on, especially considering developing countries that seek to attract foreign direct investment. The emphasis by developers in the developed market on function based factors of grid availability and competency within the technical factors is an indication of their priority as compared to the maturity of solutions, which was the interest for the entrepreneur and first time developer in the developing market as shown in Chapter 6. This clear segregation is an indication for the policy makers to target areas of interest that will lower uncertainty for the market actors with experience as such opening up the market and fostering diffusion.

The most significant limitation to this study is that of access to decision makers. The issue of access is not merely that of access to the actors but access to reviewing processes in order to understand internal workings. This is understandable because these are artefacts, which could in some cases be the source of competitive advantage to the firms of interest. In terms of further work, the framework can be extended to other industries. This is relevant especially since the flexibility theme was really not applicable in this case to verify its value. The test of indicator prioritization across the different dimensions cannot be generalized in this case due to the number of participants. Research can be extended to take up a more qualitative approach where access to a large sample size can be secured.

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Appendix

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